A CHILTON PUBLICATION

The Iron Age

THE NATIONAL METALWORKING WEEKLY October 9, 1952

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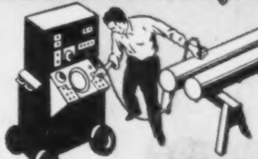
Tool Steel Topics



BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

CARBON TOOL STEEL— Toolmakers' First Choice

So many tool steels have been developed for special applications that some people overlook the many uses for carbon tool steels. Actually they're used in larger quantities than any other type of tool steel. An experienced toolmaker usually considers them first, recognizing that they are the logical steels for a starting point.

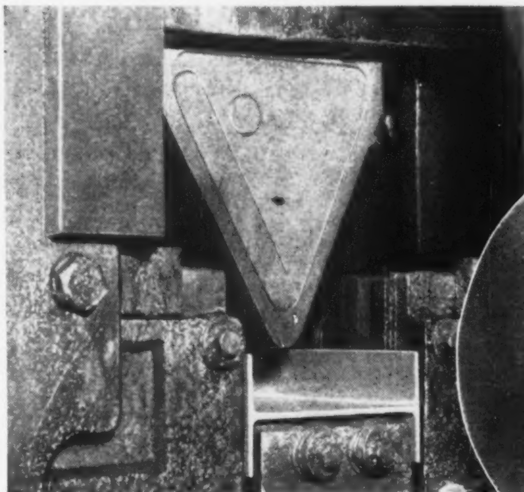
Here's why carbon tool steels are so popular:

- Easiest to machine of all tool steels
- Easy to heat-treat
- High surface hardness reinforced by a tough core
- They develop keen cutting edges

Hand chisels, center punches, and various shock tools are usually made from carbon tool steel having a carbon content of from 0.75 to 0.85 pct. Other ranges of carbon content: 0.90 to 1.00 for cold-heading dies; 1.00 to 1.10 for general-purpose tools and dies (this is the most frequently used analysis); and 1.15 to 1.25 carbon for stone-dressing tools, drawing dies, etc. Our carbon-vanadium steels, containing an addition of 0.15 to 0.25 pct vanadium, have similar applications in many instances.

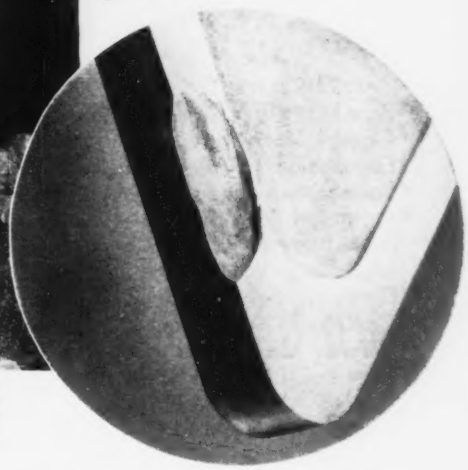
The controlled hardenability and spheroidized structure of all Bethlehem carbon and carbon-vanadium grades assure uniform response in heat-treatment. Our extensive metallurgical research has established the ideal degree of hardenability for a wide range of applications. Your nearest Bethlehem distributor and our mill depot are at your service when you need top-quality carbon tool steel.

It's easy to machine this chamfering tool holder because all Bethlehem carbon tool steels are carefully spheroidize-annealed to provide a structure that's ideal for easy machining, easy heat-treatment.



After the triangular blade descends and shears a coupon from the web of the steel beam, it moves first to the left and then to the right to shear off the flanges. The lower knife is not visible.

The edge of this shear blade chipped because of misalignment which allowed it to strike the bottom blade. Heat-checking, caused by unexpected high temperatures, is also to blame for such failures.



When cold cuts make hot blades

The shear blades usually lasted about one week in a fabricating shop where steel beams and channels were cut in large quantities. Bad spalls on the cutting edges made it necessary to change blades about once a week, and it was taken for granted that little could be done to make them last longer.

One of our metallurgical men learned of this while in the shop on another job. He began to investigate and soon found that the "cold" cutting was generating about 700 F on the blades. This caused the tool steel to develop heat-checks. In addition, the blade was overloaded due to poor alignment which allowed it to strike the bottom blade. The combination of heat and overload explained the poor service life.

The solution: Hot-Work 8, one of our hot-work steels, was tried. It's an 8-pct molybdenum analysis that's tops in wear-resistance when operating temperatures are high. Tempered at 750 F, the first blade made a total of 45,000 cuts. The best previous record was 7,700 cuts.

Here's another instance of how the practical experience of our metallurgical contact men helps to put the finger on tool steel troubles.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Heat-treat the tool, not the thermocouple

Improper temperatures during heat-treating frequently cause tool failures. In many instances the thermocouple chart shows proper heat-treatment temperatures, but the microstructure of the tool proves that the temperatures recorded were not attained by the tool. This is known as "heat-treating the thermocouple instead of the tool."

Most furnaces show some non-uniformity of temperature — locations near the source of heat are hotter than remote locations and the bottom tends to be colder than the top. A survey of each furnace will reveal the temperature differences which are present. This information makes it possible for the operator to select the location which will indicate most accurately the temperature of tools heated in the furnace; quite often the need for more than one thermocouple is apparent.

A thermocouple indicates the temperature of its tip only, so it's good practice to place the tip of the thermocouple as near to the tools as possible. Locations near the floor, sides, roof, or near the source of heat should be avoided. The thermocouple is an accurate and highly useful device, but it's not foolproof.

The Iron Age — DIGEST

Vol. 170, No. 14
October 9, 1952

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★ **Starred items are digested on opposite page.**

THE IRON AGE, published every Thursday by the CHILTON CO. (INC), Chestnut & 56th Sts., Philadelphia 39, Pa. Entered as second class matter, Nov. 8, 1932, at the Post Office at Philadelphia under the act of March 3, 1879. $8 yearly in United States, its territories and Canada; other Western Hemisphere Countries, $15, other Foreign Countries, $25 per year. Single copies, 35¢. Annual Review and Metal Industry Facts Issue, $2.00. Cables: "Ironage," N. Y.

NEWS AND MARKETS

STRUCTURALS SHORTAGE WILL HOLD INTO '53—P. 196
Generally, steel supply is expected to ease in early 1953. But this may not be true of structurals and heavy plate for construction. Some observers say structurals will stay tight almost all next year. Demand is heavy and strike losses really hurt. Quote 9-month delivery on fabricated steel.

HOW TO PLAN FOR BUILDING RURAL PLANT—P. 197
Management of many companies planning to move to more rural surroundings are asking searching questions and getting encouraging answers. These areas want industry to move in. But the company must weigh advantages against disadvantages. They should take positive steps to hold the area's good will.

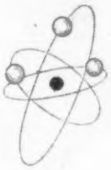
DETROIT AUTOMAKERS IN LABOR MAN HUNT—P. 199
Automakers are engaged in an intensely competitive hunt for workers. Many incidents point to a labor tightness—if not a shortage. Manpower in metropolitan Detroit is virtually exhausted. Outlying areas are suffering more severely. Many signs point to a long-term tightness if good business continues.

SET THIRD ROUND ALUMINUM GROWTH GOAL—P. 200
The government is ready to back a third round of aluminum expansion—this time to the tune of 200,000 tons of new capacity. Except as last resort no cash aid is planned but U. S. will show leniency in granting certificates of necessity. As usual new firms will be encouraged to enter the business.

WILL OPS HELP IN BEEFING UP PROFITS?—P. 204
Manufacturers are camped at OPS' doorstep demanding that some means be given them to pass along higher costs in labor, transportation, etc. Higher costs have dealt profits a hard blow. Pass-through of higher costs for a few basic metals is hardly a solution. OPS is stubborn in yielding genuine relief.

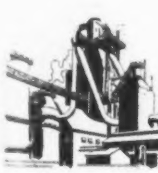
STEEL OUTPUT, DEMAND REACHING NEW HIGH—P. 39
Record steel production is being snatched up by strike starve consumers as fast as it can be shipped. Only signs of sof spots found in a very tight market are in specialty item wire, straight chrome stainless, and silicon sheets. Shippin pressure is causing shortage of freight cars in some area

of the METAL SHOW ISSUE



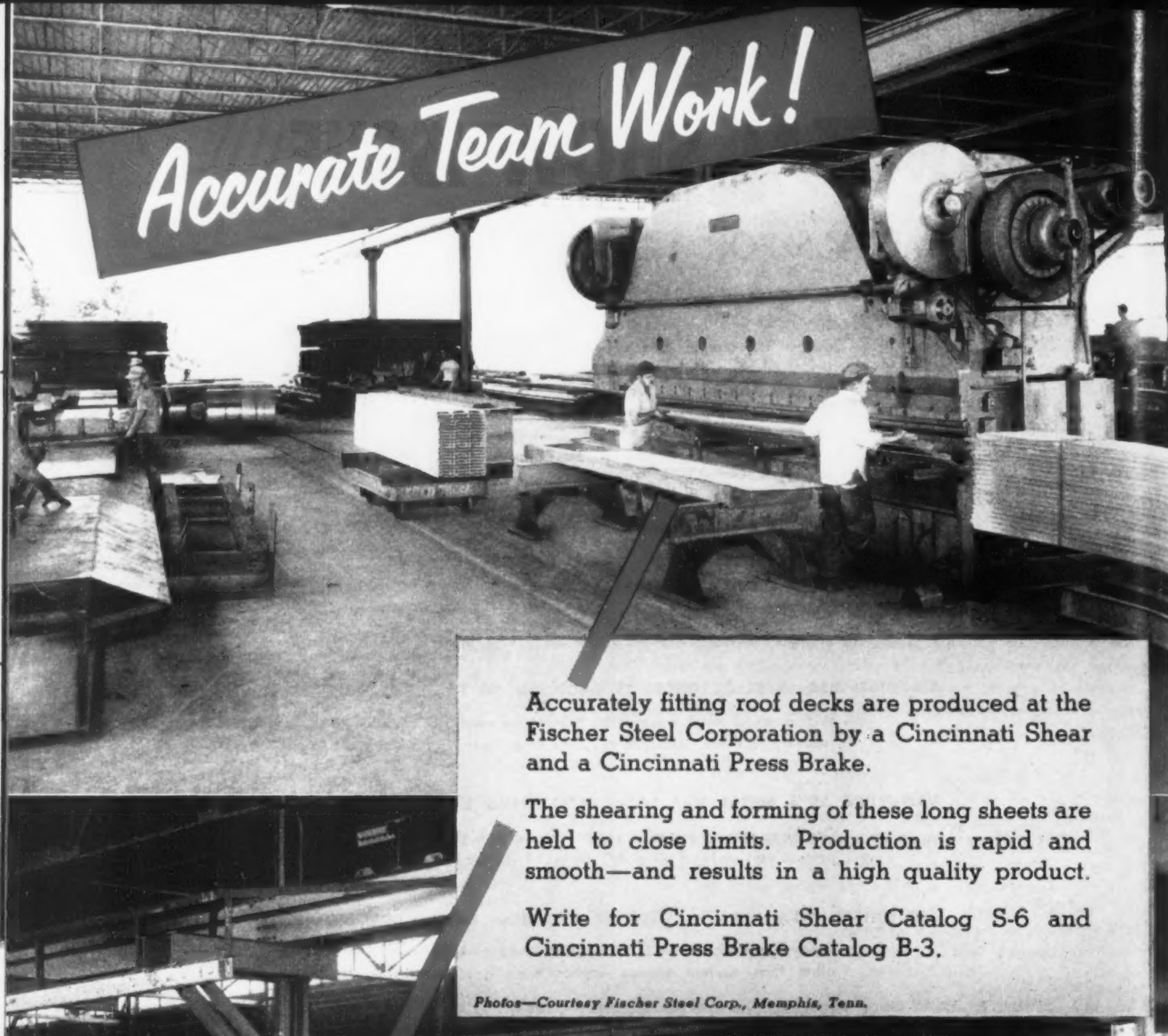
METALS FOR TOMORROW

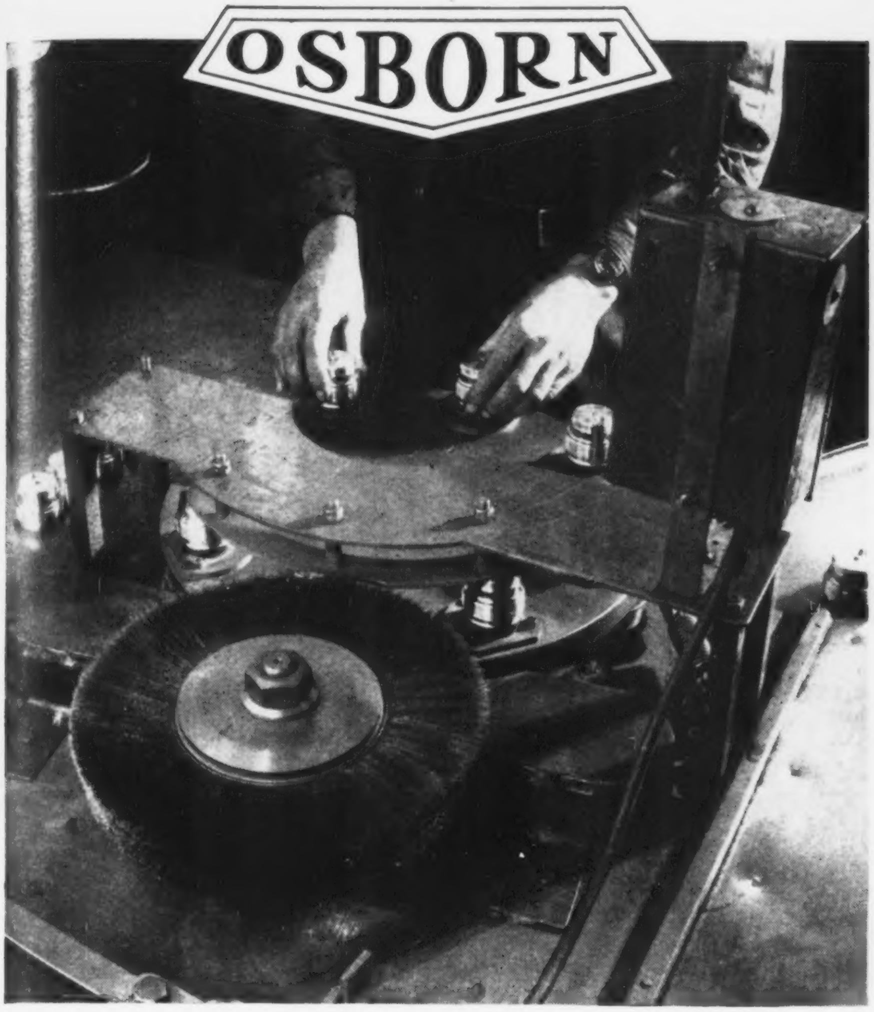
THE ROAD AHEAD



EVOLUTION IN STEEL

METAL SHOW PROGRAM


Accurate Team Work!
Accurately fitting roof decks are produced at the Fischer Steel Corporation by a Cincinnati Shear and a Cincinnati Press Brake.
The shearing and forming of these long sheets are held to close limits. Production is rapid and smooth—and results in a high quality product.
Write for Cincinnati Shear Catalog S-6 and Cincinnati Press Brake Catalog B-3.
Photos—Courtesy Fischer Steel Corp., Memphis, Tenn.
CINCINNATI
THE CINCINNATI SHAPER CO.
CINCINNATI 25, OHIO, U.S.A.
SHAPERS • SHEARS • BRAKES



Why 400?
Deburr 1400 per hour!

Here's how a manufacturer of brass components for ammunition has stepped up production with Osborn Power Brushing:

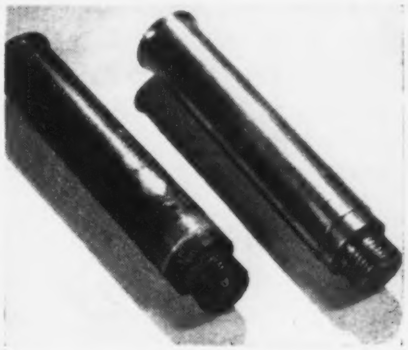
In the removal of feather burrs from threads and the machined surface of these brass parts, former output was 400 per hour. With the help of the **O**sborn **B**rushing **A**nalyst, this company designed the brushing machine shown. The parts are placed on spindles of a rotating table. As they pass the Osborn Monitor Brush, they rotate and expose the entire face uniformly to the brush. Parts come clean and smooth . . . at a rate of 1400 per hour! And in another machine, Osborn Brushes deburr the internal threads of this part . . . smooth and fast!

Have the **OBA** show you production-boosting ideas for your shop! Call today or write, *The Osborn Manufacturing Company, Dept. 836, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

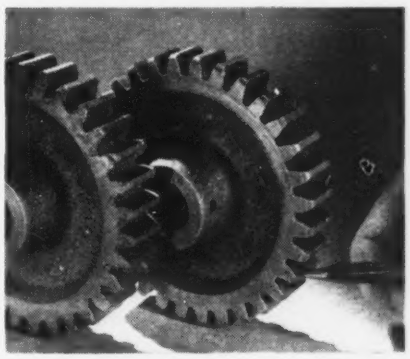
Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

"CENTERLESS BRUSHING" speeds the production of fine finishes for cylindrical parts such as this compressor piston. One user of this Osborn-developed method gets micro-smooth finishes at outputs as high as 10,000 pistons per 8 hours. Can be applied to many sizes of parts and types of material.



CLEANS SCALE. Heat treat scale on the tube at the left is removed by Osborn power brushing. Result, shown at right, is perfectly clean surface, ready for painting. Have an **OBA** study your product cleaning operations to find ways to cut their cost.



FASTER DEBURRING. Here's another "before and after" example of gear deburring with the Osborn Work Holder Brushing Lathe. Burrs and sharp edges are removed uniformly. Production increases of 20% to 1570% are being reported by users.

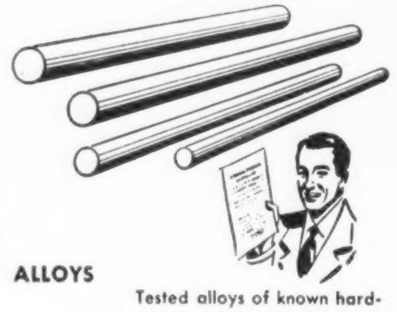
SEE YOU AT METAL SHOW

Let us discuss your brushing problem at Osborn Booth 729.

RYERSON

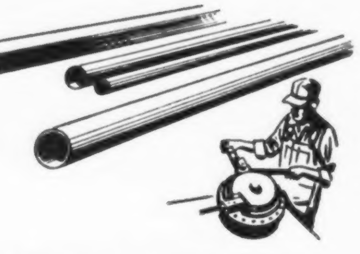
The Industrial P. A.'s Department Store

Here are a few of the many types of steel and related products on hand right now, ready for immediate shipment from your nearby Ryerson plant. Many may be used in place of products that are still hard to get. Check the items you need, and save time by ordering them next time you call Ryerson.



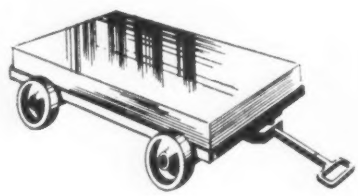
ALLOYS

Tested alloys of known hardenability, both standard and aircraft quality. Complete heat treatment guide with each shipment.



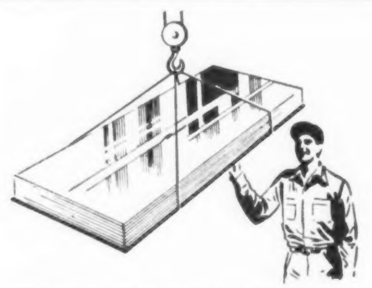
WELDED MECHANICAL TUBING

Hot and cold rolled, rounds and squares in a wide range of sizes. Consider cost. Substitute for seamless tubing.



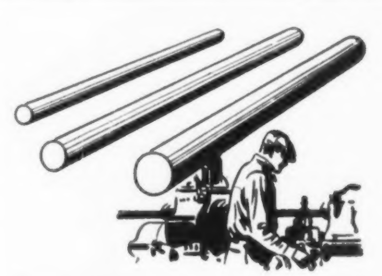
CARBON SHEETS

Both hot and cold rolled coming into better supply, especially cold rolled in the heavier gauges.



STRAIGHT CHROME STAINLESS

No allotment required for these stainless bars, plates and sheets—and they can often replace restricted nickel-bearing types.



TOOL STEEL

Water, oil or air hardening steel. High in quality; economical in price. Hardening data with every shipment.

SAFETY PLATE

Strong, non-skid Inland 4-Way Safety Plate protects feet against slipping, floors against wear. Easily fabricated.

CHAIN & WIRE ROPE

Rugged, dependable TM chain, iron, steel and alloy qualities, furnished to order. High quality wire rope shipped from large stocks.

BABBITT METAL

Glyco Babbitt, an exclusive Ryerson product, has physicals equal to high tin Babbitts; costs substantially less and is unrestricted.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETRO
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATT

THE IRON AGE

Editorial, Advertising and Circulation Offices, 100 E. 42nd St., N. Y. 17, N. Y.

GEORGE T. HOOK, Publisher
TOM C. CAMPBELL, Editor

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Indexed in the Industrial Arts Index and the Engineering Index.

Society of Business Magazine Editors

Controlled Circulation Audit

National Business Publications

Gird Yourself

IT won't be long until the defense program will have reached its peak. Then there may be a plateau. We will have defense problems for a long time. But as we already know, American productive practices and potential can fit them into our everyday work.

This country has potential and capacity undreamed of just 10 years ago. Technical progress and productive efficiency have advanced to the point where they alone have held back inflation.

For 12 years the production of goods and services has responded to a demand that seemed to be insatiable. During that period there was enough business for anyone who wanted to take orders or show a minimum of sales effort.

The increase in the population, the satisfaction of deferred demand, and the defense program have all contributed to full employment and top level output.

The party is coming to a close. Next year or at least by 1954 industry in America will face one of the most competitive periods in its history. The capacity is there, the workers are there, the technique is there. Just how each of these will be used will determine the business mortality rate in the years to come.

Cost-cutting, or at least cost-saving to offset unprecedented wage payments with their increasing amount of fringe benefits, must be met if our industrial world is to survive. There are practical ways of getting in on the ground floor of this necessary movement.

In this special Metal Show issue the editors of THE IRON AGE have prepared a complete report on some relatively new and little known metals. Their sources, their fabrication and their present and potential uses are realistically reported and interpreted.

In this issue the advertisers in the metalworking industry are displaying for you their answers for less cost, better quality, new products and proven methods. They are aware of what problems you face next year and the years after.

At the National Metal Exposition in Philadelphia, Oct. 20-24, metalworking and metal producing firms will show you on the spot what their products will do for you; at the Metal Congress the brains of the metalworking industry will hold meetings and discussions on your problems of the future based on the present.

Tom Campbell

Editor

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Dear Editor:

Letters from readers

Younger Generation

Sir:

Your editorial "The Younger Generation" of Sept. 18 was most encouraging. Too often the many pointed facts which you so aptly brought out are soft-peddled everywhere. The great majority of men who read your editorials are in a position to do something about it and I do pray that after analyzing their own lives they will, by God's strength, seek to serve Him and their fellow man and lead "the younger generation" in the right way.

T. R. ALLEN, JR.
Treasurer
Continental Iron & Steel Co.
New York

Sir:

The editorial feature of IRON AGE is always found enjoyable. May I extend my compliments especially on "The Younger Generation" appearing in the Sept. 18 issue. This brings into clear focus the basic causes of degeneracy in youth.

N. J. FINSTERWALDER
Chief Metallurgist
Taylor Instrument Companies
Rochester, N. Y.

Plastic Dies

Sir:

On p. 83 of your Sept. 11 issue you make a statement regarding the use of plastic dies. You indicate that a major producer may be about ready to take them off the experimental list and use them in production.

Can you advise us the name of this producer or give us more information on the use of plastic dies.

K. F. BURGESS, JR.
Illium Corp.
Freeport, Ill.

The company using plastic dies in production is Chrysler Corp. For more details see our story on p. 119 of the Sept. 18 issue. —Ed.

Costs

Sir:

On p. 59 of your Sept. 25 issue, in spelling out the difference in costs to a purchasing agent for a 7 in. standard I beam, you mention a price range for imported steel of $165 to $185 per ton delivered Chicago.

This institute includes most foreign mill agents and a good number of the well established importers of steel. The price range mentioned in your article is not indicative of the prices quoted for imported steel by the established firms. A figure of $132 to $140 per ton delivered in Chicago depending upon quantity and transportation is very much closer to the actual cost and compares with a mill price of $86, a warehouse price of $146, and a conversion price of $166.

Thus, even in the Chicago area, which from an importer's point of view is in an unfavorable freight location, the present prices of the imported product compare favorably with the cost for warehouse and conversion steel. In other areas closer to the seaboard the price comparison for imported steel is considerably more favorable.

N. SCHILLING
President
American Institute for Imported Steel, Inc.
New York

Higher prices in The Iron Age article were obtained by contacting three import houses with offices in Chicago.—Ed.

Unloader

Sir:

Please send us the name of the manufacturer of the Rajon car unloader reported on p. 63 of your July 24 issue.

H. V. GULICK
Chief Engineer-Manufacturing
American Locomotive Co.
Schenectady

The manufacturer is MFI, Inc., 1357 N. Sedgwick, Chicago 10, Ill.—Ed.

Radioactive Tools

Sir:

Our foundry section is interested in the article "Radioactive Tools Permit Fast Tool Wear Studies" which appeared on p. 154 of your Sept. 4 issue. We would appreciate 3 copies.

L. C. STRONG
Manufacturing Research Dept.
International Harvester Co.
Chicago

Liquid Coolant

Sir:

May we have permission to reprint two 4-page articles that appeared in your Apr. 17 and Aug. 14 issues on the subject of CO_2 as a liquid coolant?

W. C. BETTES
Pure Carbonic Co.
New York

Transfer Equipment

Sir:

Will you please send us a few tear sheets of the article "Transfer Equipment Stresses Flexibility, Cuts Cost" which appeared in Sept. 11 issue.

M. R. BISHOP
Director of Public Relations
Willys-Overland Motors, Inc.
Toledo

Fatigue Cracks

by Charles T. Post

Metals for Tomorrow

Your favorite family journal is bursting its seams this week, just as it does every year at this time in anticipation of the National Metal Show.

Don't get the idea that the special 24-page section on "Metals for Tomorrow" was easy to get together, even for your f.f.j.'s brains department. The editors first got the idea last Spring and it was gestating right up until press time on Tuesday. The title, "Metals for Tomorrow," is full of portent, but it makes us feel very old. We can remember very well sitting in Chem class in high school and studying the periodic chart. Most of the metals now coming into common use were no more than symbols on it.

Incidentally, if you would like to have a copy of the "Metals for Tomorrow" section for your file, just let us know. A few reprints are being made, and we are pretty sure we can snitch up to half-a-dozen per customer, on the house.

Titanium

Our Harlem reporter swears that Titanium is coming into high favor as a name for baby girls born in the neighborhood.

At first glance, it sounds sort of attractive, what with all the talk about the "Cinderella metal" and so on. But when the babies grow up, we hate to think that they will take on the attributes of the metal—cold in appearance, expensive.

Chew

Once in a while we pick up one of the trade papers that circulate among advertising men, and almost invariably we get the willies at some of the weapons the boys use to sneak up on us.

For instance, *Advertising Age* a couple of weeks ago had a long piece on how Wrigley gums advertising agency worked with social and psychiatric scientists "to uncover and analyze the emotional factors concerned with chewing, with particular application on why people chew gum." The study was made at the Institute of Psychoanalysis in Chicago.

So far as our friends are concerned—them as chews—we'd always supposed that they liked the flavor of Tutti-Frutti, were trying to give up smoking with Doublemint, or chose Spearmint after they had gulped three Martinis at lunch and had to face the boss or a customer.

We were all wrong. One of the three basic reasons people chew gum, *Advertising Age* tells us, is "symbolic hostility or aggression." Maybe our gum chewing friends aren't our friends at all, and we had better watch out for a stiletto in the back. Other reasons: (1) Oral comfort; (2) release of tension, or relaxation. Even if they aren't sore at us, then, they are comfort-seeking bums about to lie down on the job. Those are no kind of people to be associated with.

Anyhow, this advertising agency really took a deep plunge after finding those things out. It started building some advertising around a frustrated child, going from there to a similar adult situation. The ads sold lots of gum in eastern Pennsylvania, and it looks as though they may close in on the rest of the country.

If this sort of thing keeps up, we are going to be darn careful before we read the ads—except in your f.f.j., of course—or conflicting approaches to our subconscious will land us on the psychiatrist's couch for sure and we'll have to park our gum surreptitiously below the upholstery.

Puzzler

The deeper we get into this puzzle business, the more convinced we are that some puzzles are classics that were probably pondered by the Greek philosophers for relaxation. We knew that the problem of the 12 counterfeit dollars had driven Fatigue Cracks readers nutty a few months ago, only we called them golf balls then. But now Noel F. Jannotta of the Philadelphia Toboggan Co. writes that "Don Rose, a columnist for the *Evening Bulletin*, picked it up from his nephew two years ago and after some controversy as to whether it was possible to solve or not, he finally put it in his column for readers to take a crack at. That really started something around Philadelphia in various engineering rooms, but I finally solved it after too long a time (believe me, that was a stinker) and sent it in . . . for which he gave me honorable mention in his column."

Oh, yes. Mr. Heilman had 24 chickens in his flock. No puzzle this week, children. You'll want to spend your time reading about "Metals for Tomorrow."

Conventions & Meetings

Oct. 8-10—Compressed Air & Gas Institute, semi-annual meeting, Shawnee Inn & Country Club, Shawnee-on-Delaware, Pa. Institute headquarters are at 90 West St., New York.

Oct. 10-11—American Society of Tool Engineers, International Area Meeting, Statler Hotel, Buffalo. Society headquarters are at 10700 Puritan, Detroit.

Oct. 11-14—National Assn. of Waste Material Dealers, National fall meeting, Hotel Ambassador, Los Angeles. Association headquarters are at 271 Madison Ave., New York.

Oct. 13-17—American Institute of Electrical Engineers, Fall General Meeting, Jung Hotel, New Orleans. Institute headquarters are at 33 W. 39th St., New York.

Oct. 14-16—Seventh Annual Industrial Packaging & Materials Handling Exposition, Chicago Coliseum, headquarters are at 20 W. Jackson Blvd., Chicago.

Oct. 16-17—Gray Iron Founders' Society, Inc., 24th annual meeting and convention, Hotel Cleveland, Cleveland.

Oct. 17-19—Metal Treating Institute, annual meeting, Hotel Warwick, Philadelphia. Institute headquarters are at 271 North Ave., New Rochelle, New York.

Oct. 19-21—Conveyor Equipment Manufacturers Assn., Annual Meeting, The Greenbrier, White Sulphur Springs, West Virginia. Association headquarters, 1129 Vermont Ave., N. W., Wash., D. C.

Oct. 19-24—American Welding Society, 33rd National Fall Meeting, The Bellevue-Stratford Hotel, Philadelphia, Pa.

Oct. 20-22—American Institute of Mining and Metallurgical Engineers, Institute of Metals Div., fall meeting, Hotel Adelphia, Philadelphia. Institute headquarters are at 29 W. 39th St., New York.

Oct. 20-24—National Metal Congress & Exposition, Convention Hall, Philadelphia.

Oct. 20-24—National Safety Council, national safety congress and exposition, Chicago. Council headquarters are at 20 N. Wacker Dr., Chicago.

Oct. 21—Gas Appliance Manufacturers Assn., Industrial Gas Equipt. Div., Hotel Warwick, Philadelphia.

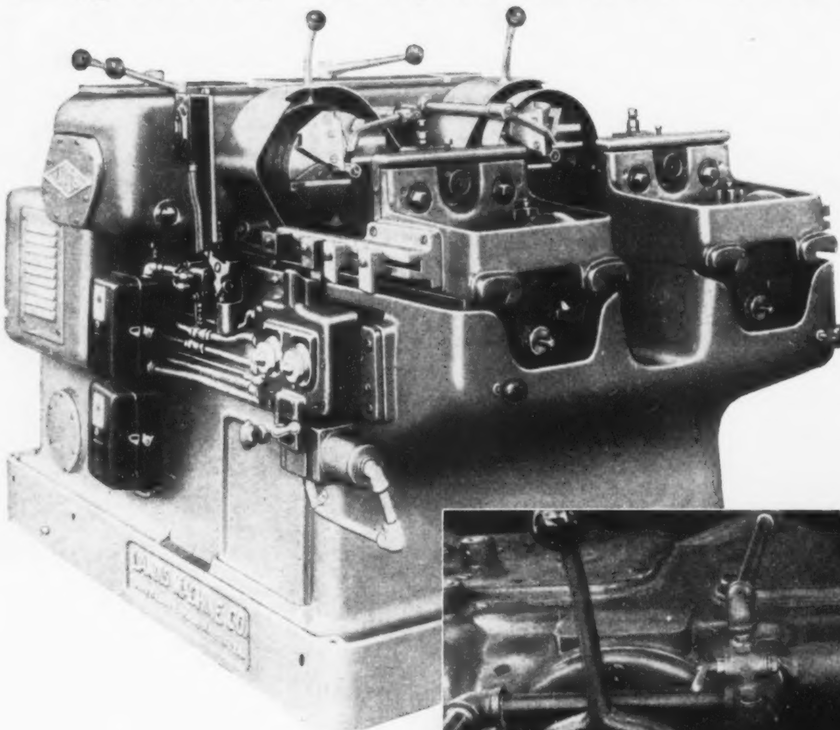
Oct. 22-24—Society of Automotive Engineers, Inc., National Transportation Meeting, Hotel William Penn, Pittsburgh. Society headquarters are at 29 W. 39th St., New York.

Oct. 23-24—Steel Products Warehouse Assn., annual meeting, Waldorf-Astoria Hotel, New York.

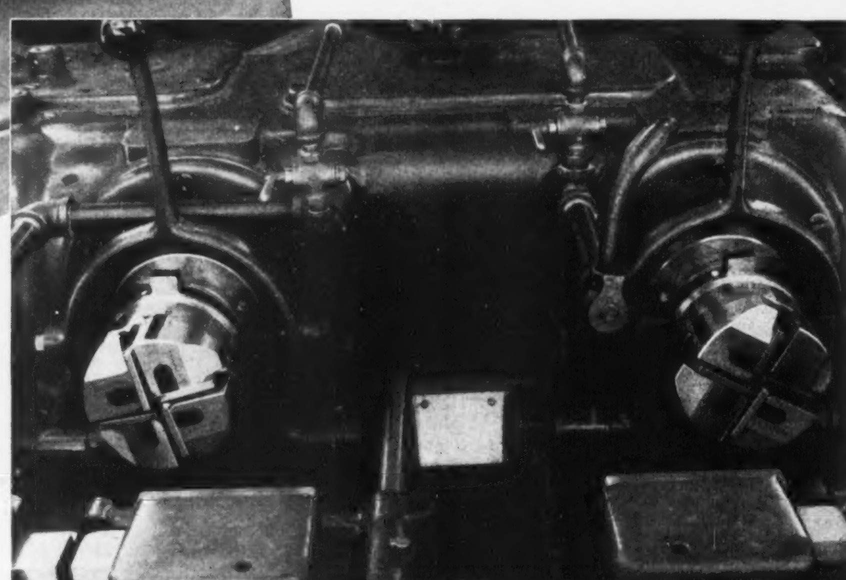
Oct. 24—Malleable Founders' Society, Western Section Meeting, The Drake, Chicago. Society headquarters are at Union Commerce Bldg., Cleveland.

HOLLOW MILLING

Extra LANDIS Feature . . .



LANDIS Die Heads, in addition to conventional threading operations, can be equipped with LANDIS Turning Cutters which will perform turning, grooving, forming, and facing by the hollow milling method. Milling operations may be performed by LANDIS Heads applied to automatic screw machines, turret lathes, or LANDIS leadscrew-type or hydraulic-feed threading machines, and other positive-feed-type machines.



Many Production Advantages

Hollow milling by this method offers an increased efficiency occasioned by the application of a multiple number of cutting tools. The feed rate is thus approximately equal to that of a single tool, multiplied by the number of simultaneously-functioning cutters in the unit—four or six for LANDIS Heads.

The LANDMACO Double Head Leadscrew Threading Machine affords a particularly efficient hollow milling method. One carriage will perform the milling operation while the other carriage is being loaded by the operator, thus allowing consistent continuous production. In addition it is entirely practical to perform milling operations on one spindle and conventional threading operations on the other.

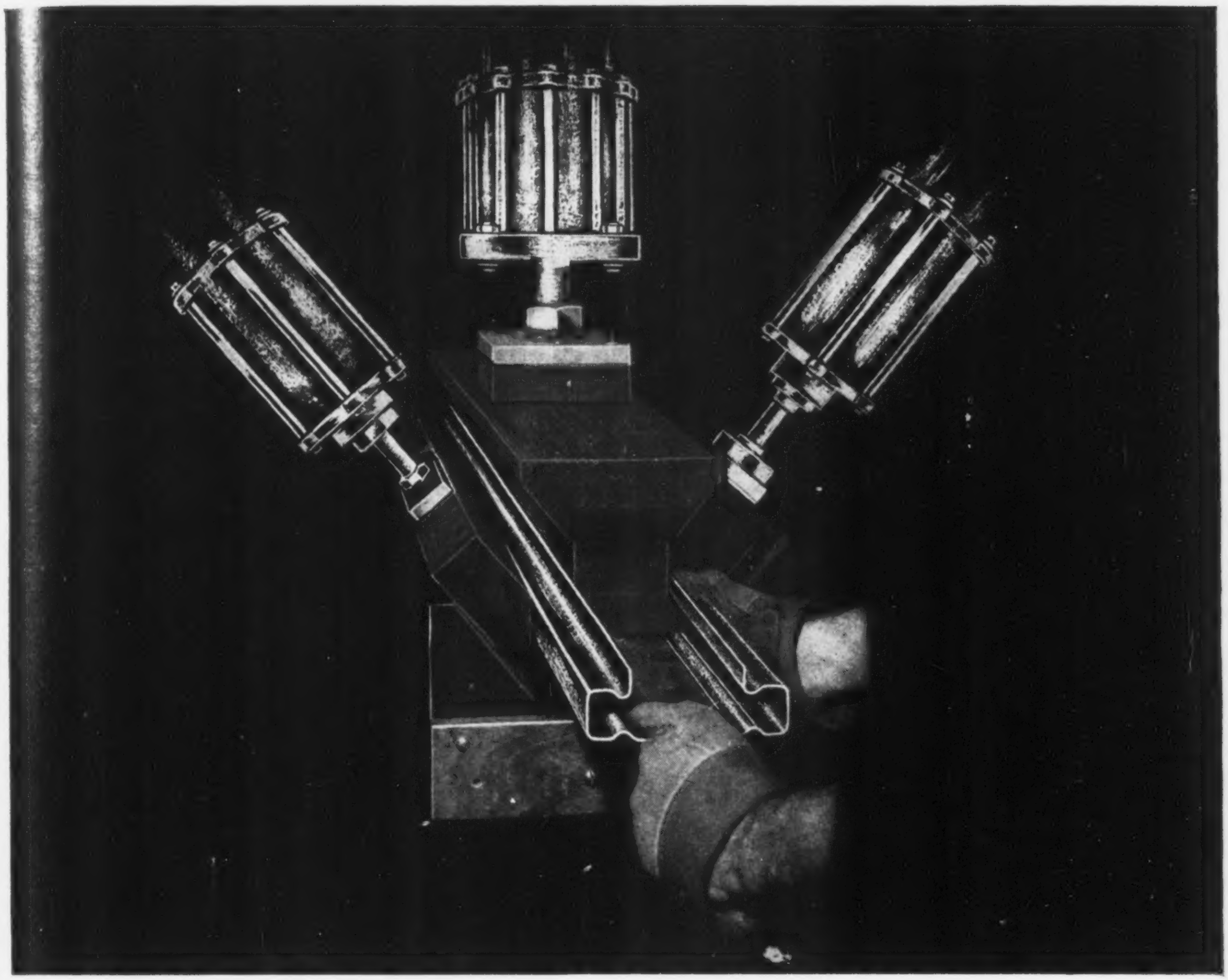
LANDIS Turning Cutters

LANDIS Cutters are economical tools for they are usable for most of their original length. Only the rake angle needs regrinding—a quick and simple procedure. One set of cutters will machine a wide diametrical range of work, and cutting speeds will range from 30 to 70 linear feet per minute.

Wear and breakage of tools and spoiled work is held to a minimum. The cutting edges of the cutters can be precisely and uniformly located with relation to the center line of the work since they are diametrically-opposed in the cutting position. Thus with cutting strains evenly distributed, the workpiece is never forced out of alignment.

Additional information will be supplied on request—please include specifications.

LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA



Forming metals in press equipped with draw dies fabricated from Formica "Gauge-wood"

NEW TOOLS FOR METAL FORMING

There's a new source of tools for the metalworking industries—*densified wood,* product of the union of wood and BAKELITE Phenolic Resins. Aircraft part templates, bearings, automotive part dimension gauges, drill jigs, and foundry patterns are already being made from this unusual material. Its advantages—high impact strength, comparatively light weight, ease of repair, and economy.

Densified wood, in the form known as Formica "Gauge-wood," is made into tools that maintain their exact size and shape under variable conditions of heat and moisture. It is dimensionally stable, resistant to water, chemical attack, abrasion, and warping. It can be bored, threaded, tapered, grooved or machined to close tolerances, then buffed to a high surface luster. It may be altered or repaired quickly and economically by patching.

Cross-laminated veneers are impregnated with BAKELITE Phenolic Resins and pressed to 50% of the original thickness to form densified wood, making it a hard, compact, wood-resin structure. Harder than any solid wood, lighter than any solid metal, it is well suited to jobs requiring strength, stability, and accuracy. It may be useful in your operations. For information, write **Dept. DZ-44,** requesting a copy of booklet H-12, "Densified Wood Made with BAKELITE Phenolic Resins."

BAKELITE
TRADE-MARK
PHENOLIC RESINS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

BS **Productioneered**

for unusually broad utility

No.13 UNIVERSAL AND TOOL GRINDING MACHINE

Most versatile of the Brown & Sharpe grinding machines, this model is designed primarily for broad utility in the toolroom — but can also be speedily set up to care for limited over-flow of manufacturing work.

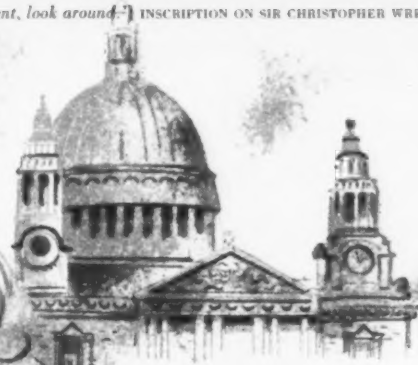
No.5 CUTTER AND TOOL GRINDING MACHINE

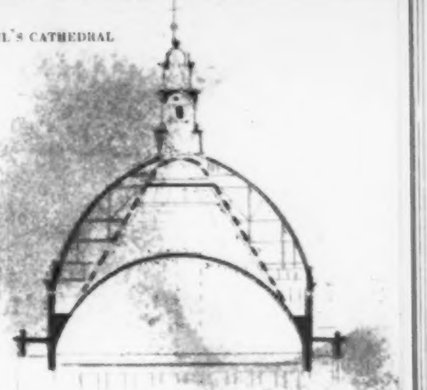
Especially designed for fast, efficient sharpening of cutters and tools — particularly smaller cutters and end mills. Additional equipment is available to further speedup sharpening in quantity.

BS **Productioneered**

for quick sharpening of tools and cutters

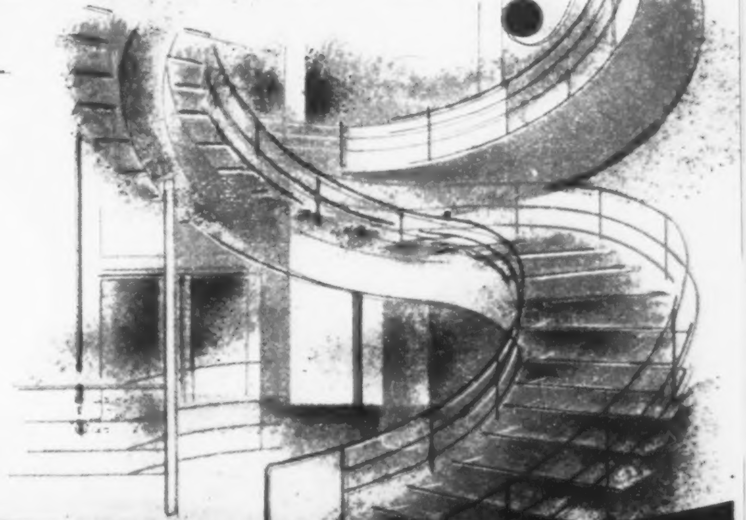
"Reader, if thou seekest his monument, look around." INSCRIPTION ON SIR CHRISTOPHER WREN'S TOMB IN ST. PAUL'S CATHEDRAL





From the ashes of the Great Fire in 1666 emerged Sir Christopher Wren's masterpiece—St. Paul's Cathedral—with its soaring central dome "rising from the mists of London, like an Alpine peak". ★ In designing the dome, Wren solved with amazing simplicity one of the most difficult structural problems in architecture—how to support a great central dome without using excessively heavy and constricting crossing piers. ★ This same simplicity, combined with unusual structural engineering knowledge, enabled Wren to produce diverse effects in his many buildings without expensive elaboration.

simplicity



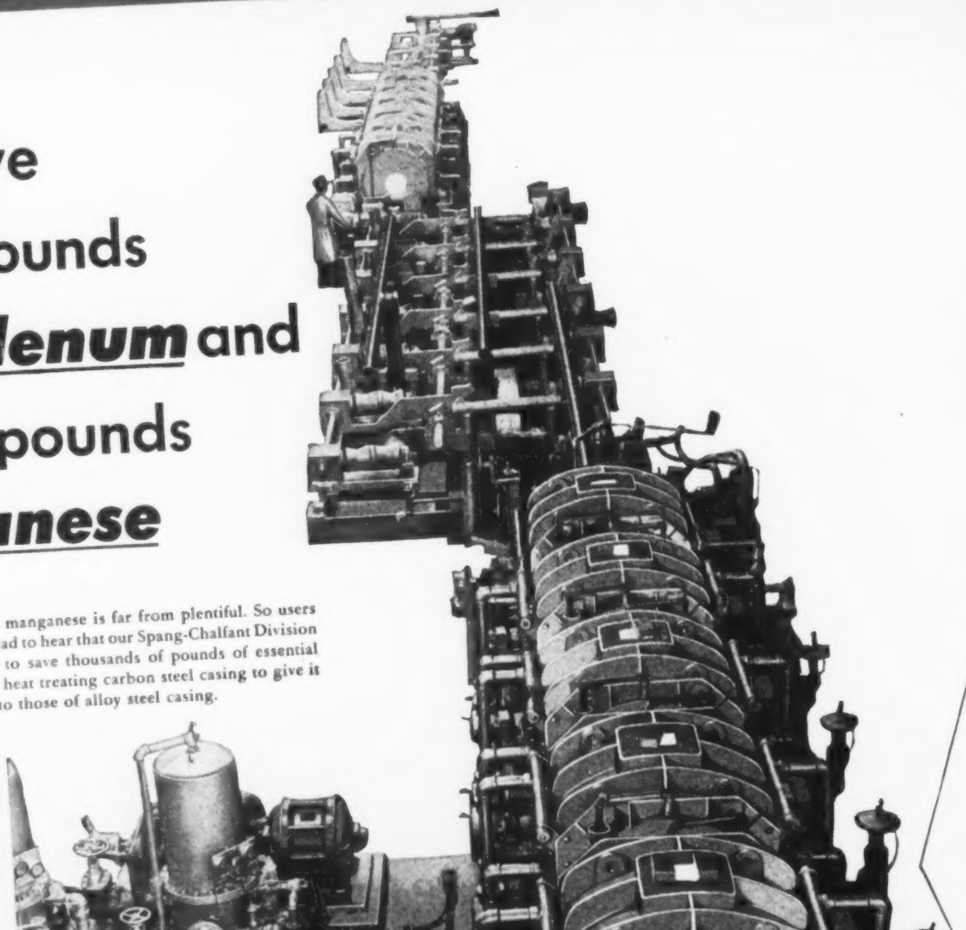
Whether hidden from sight doing a functional job, or exposed to view just looking pretty, Van Huffel metal shapes and tubing simplify a lot of today's building problems. ★ Architects, designers and engineers know they can incorporate in their designs strength without excessive weight . . . economy without sacrificing quality . . . and simplicity without complicated assembly. That's why they are continually thinking up new uses. That, too, is why they keep coming to Van Huffel —where ideas take shape—in metal.

DED · LOCK SEAM · OPEN SEAM · BUTTED TUBING · METAL SHAPES · MOULDINGS

Van Huffel

TUBE CORPORATION · WARREN, OHIO

How to save 300,000 pounds of ***molybdenum*** and 1,000,000 pounds of ***manganese***



Molybdenum is now very scarce, and manganese is far from plentiful. So users of these materials, especially, will be glad to hear that our Spang-Chalfant Division in the past four years has been able to save thousands of pounds of essential resources. The savings were made by heat treating carbon steel casing to give it high strength characteristics similar to those of alloy steel casing.

Since September, 1947, our Spang-Chalfant Division produced over 5½ million feet of high strength pipe by this process. But more important than past production may be our development's effect on future supplies of casing. Even if all molybdenum is restricted from oil field use, we will be able to produce up to 3,500 tons of high strength casing per month without it.

Research in the fields in which National Supply operates requires a great expenditure of time and money. When it pays off for our customers and for the nation as it has in the heat-treating of pipe, we consider it an excellent investment.

HEAT TREATING takes the place of scarce alloys

High strength casing, used in deep oil wells, usually is made of alloy steel containing molybdenum and manganese. Many years ago our engineers tested the idea of making it out of ordinary carbon steel, then heat treating it to give it the required ductility and strength characteristics. The difficult problem was to hold the shape of the pipe during heat treating . . . and about five years ago we learned how.

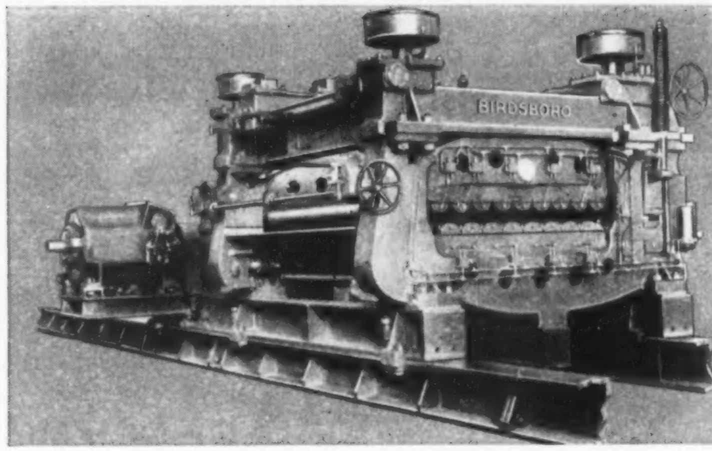
We pass carbon steel casing through the series of special, barrel-type furnaces shown here, which operate at 2800-2900 degrees. They quickly heat the pipe to 1600 degrees. Then we quench it in a high-pressure water spray, reheat it to 1100 degrees and allow it to cool. The finished pipe has the ductility and strength of alloy steel pipe, but it requires no molybdenum and less manganese in its manufacture.

THE NATIONAL SUPPLY COMPANY

Executive Offices: Pittsburgh, Pennsylvania

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT • SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES

Reprinted from WALL STREET JOURNAL



Leveling machine for hot carbon plate 3/16" to 1/2" x 100" wide.

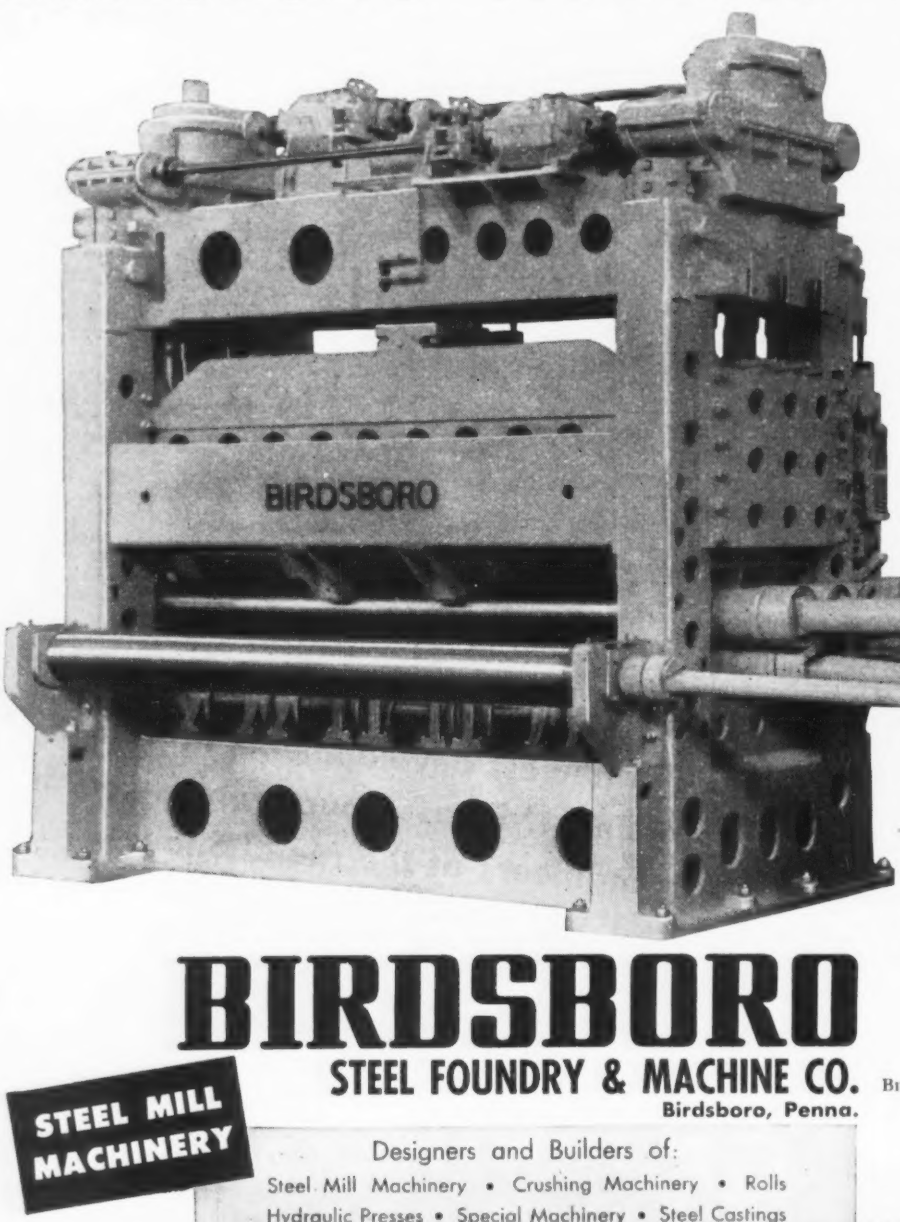
STEP UP YOUR OUTPUT-- cut down your costs

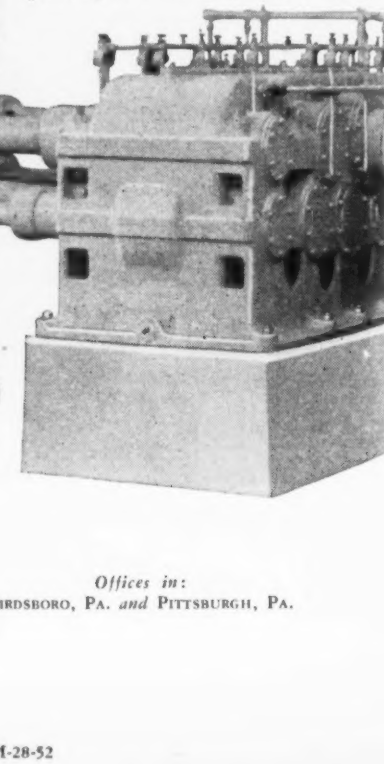
BIRDSBORO LEVELING MACHINES

On any leveling job—from heavy cold armor plate to light hot carbon plate — it takes smooth-running, maintenance-free levelers to produce volume output at minimum cost. Birdsboro precision levelers are designed, engineered, and built with this point in mind.

At your request, Birdsboro Engineers will put a diversity of design and engineering experience to work on your application to help you get the results you want.

Precision leveler for cold alloy steel plate up to 1" thick and 160" wide.





BIRDSBORO

STEEL FOUNDRY & MACHINE CO.
Birdsboro, Penna.

Offices in:
Birdsboro, Pa. *and* Pittsburgh, Pa.

STEEL MILL MACHINERY

Designers and Builders of:
Steel Mill Machinery • Crushing Machinery • Rolls
Hydraulic Presses • Special Machinery • Steel Castings

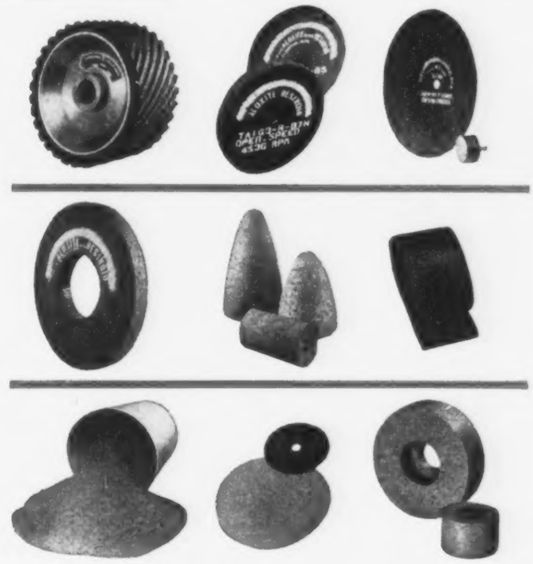
MM-28-52

switching to an abrasive BELT?

Grinding and polishing techniques have undergone major improvements in the past few years. One of many revolutionary developments is the "61" contact wheel, used with a coated belt on many operations previously performed with a bonded or a set-up wheel. In every case, the change has been made for just one reason—to yield a better result at a lower cost.

This is the kind of change that spells progress to every metalworking man who is battling against higher and higher costs. And this is the reason why you should welcome the CARBORUNDUM man or distributor salesman when he calls on you. There is nobody quite like him, for he's not in the position of having to back just one type of product, or two. He alone has the ability to help you specify the one RIGHT combination of abrasive product and abrasive method for every operation in your shop.

His counsel is experienced, practical, and above all completely free from bias—for he represents the only complete line of abrasives, from CARBORUNDUM, the world's best known brand name in abrasives. We suggest that you call him in today—it's to your profit!



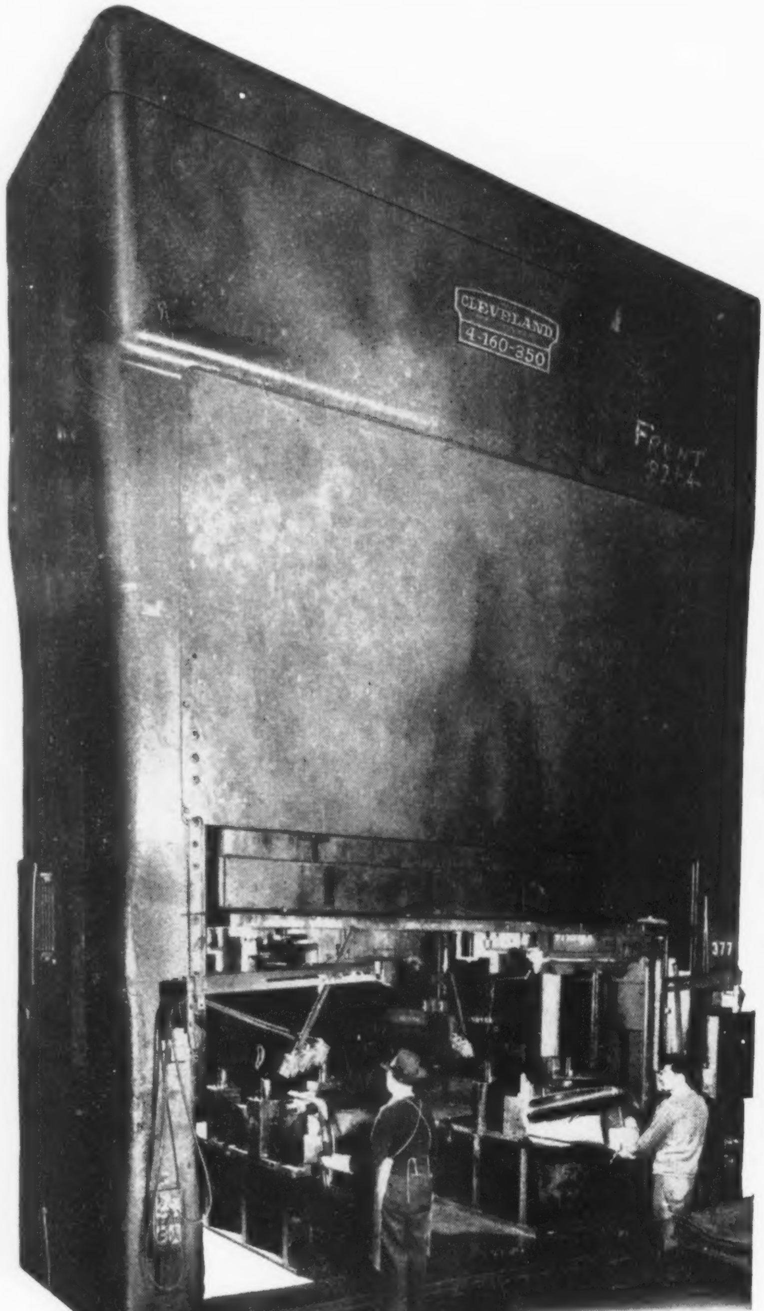
Here are only a few of the 30,000 reasons why you get the RIGHT combination of abrasive and method only from CARBORUNDUM

RUNDUM

MARK

offers ALL abrasive products...to give you the proper ONE

80-52



Four-Point Press, 850 Tons Capacity

BIG...

IN PERFORMANCE TOO!

Certainly when you buy a press you want one large enough with the necessary capacity to handle assigned jobs, but don't stop there—size isn't everything. Be sure that you get a press whose frame is designed to "take it" under the strain of continuous operation and occasional overload; a press with long enough gibbing to assure slide accuracy and protect die-life. Get a press equipped with a clutch that offers positive control, requires only occasional, easy-to-make adjustments and is economical to operate. In other words—get a CLEVELAND!

THE CLEVELAND PUNCH & SHEAR WORKS CO.
U.S.A.

PUNCHING TOOLS & DIES

FABRICATING TOOLS

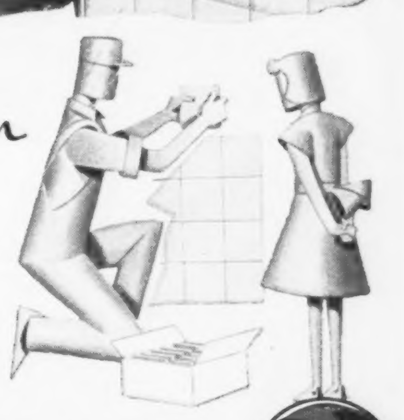
OFFICES AT:
NEW YORK....CHICAGO
DETROIT....PHILADELPHIA
E. LANSING

Established 1880

POWER PRESSES

CLEVELAND 14, OHIO

Beauty Treatment for *Your* bathroom



Bet you can't guess how little it would cost to make *your* bathroom as pretty and practical as this one.

That is, unless you already know about steel wall tile. How smart it looks. How it protects the beauty it adds. How reasonable it is to purchase and install. Because all the wall tile in this delightful room is made of steel, America's great and versatile bargain metal.

Even better for your bathroom, this wall tile is made of *Weirzin*— the electrolytically zinc-coated steel that is fireproof . . . resists moisture . . . forms a lasting bond with its finish . . . safeguards beauty permanently.

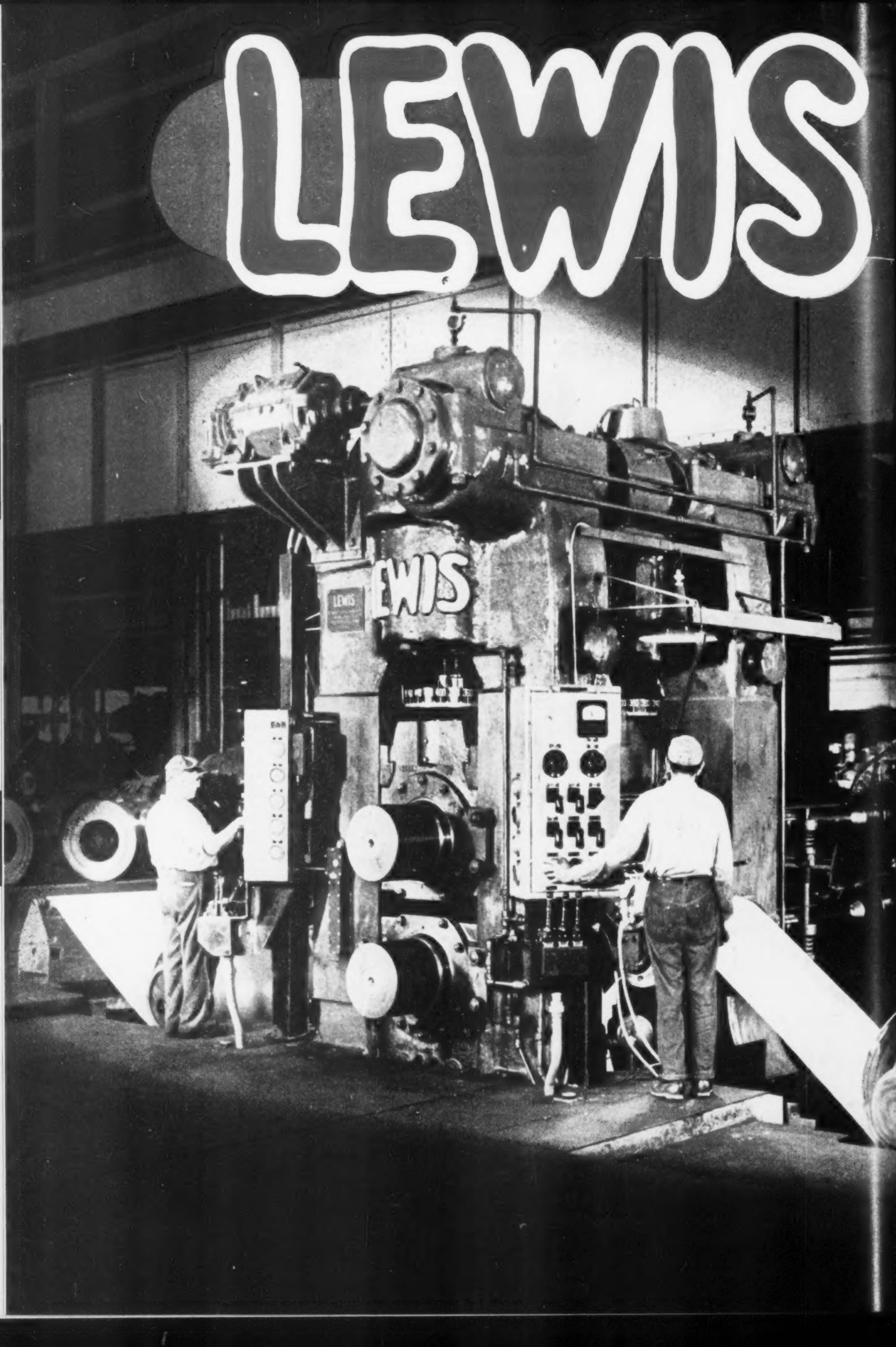
It doesn't matter whether it's wall tile or lighting fixtures, Venetian blinds or cabinets—whatever you buy, you come out ahead with steel. Make steel *your* standard—and save.

Metal sculpture executed in Weirzin demonstrates the exceptional workability of this easily fabricated metal.

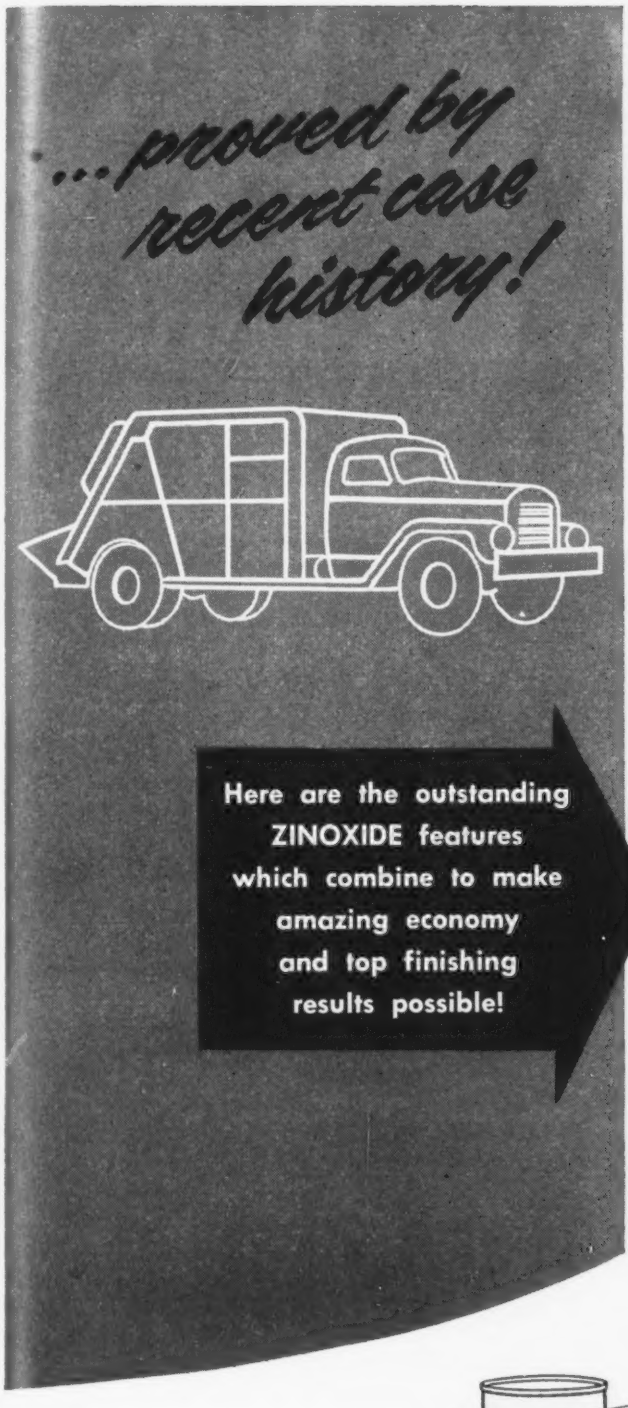
WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY WEIRTON, WEST VIRGINIA

NATIONAL STEEL CORPORATION


LEWIS
LEWIS

Primer finish at ½ the cost!



A large, well-known manufacturer of load packers* wanted to reduce finishing costs without sacrificing quality of the finished product. A Lowe Brothers "Finishing Specialist" recommended that this manufacturer replace his one-coat operation with a *two-coat* system incorporating new ZINOXIDE primer and a finishing coat of enamel. ZINOXIDE was put to the test, and an intensive time study revealed that the new system slashed 50% off material and application costs! What's more, a better looking finish resulted—a better wearing finish, too, for ZINOXIDE gave better "hold out" on the enamel!

1. Adheres perfectly to all types of metal—*and that includes aluminum!* **2.** Dries to handle in 15 minutes! Can be baked at 300° for 15 minutes or more. **3.** Eliminates bad after-effects of "overspray"—no rough primer surface to sand before finishing! **4.** Durable! Castings primed with ZINOXIDE can be stored outside without rusting. Pigments used are best rust inhibitors known. **5.** ZINOXIDE can be recoated quickly with lacquer or any type of enamel!

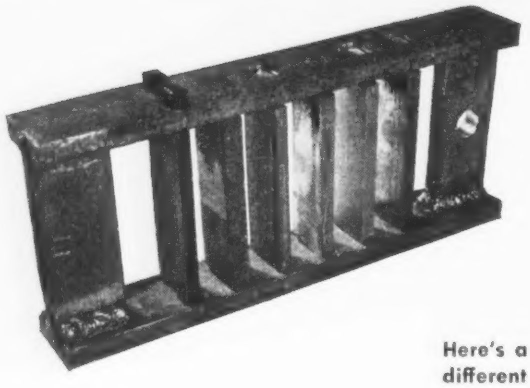
Perhaps ZINOXIDE is just what *you've* been needing to bring new finishing efficiency and finer results. Certainly worth finding out, isn't it? Ask a Lowe Brothers "Finishing Specialist." Write today.

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio
Industrial Division

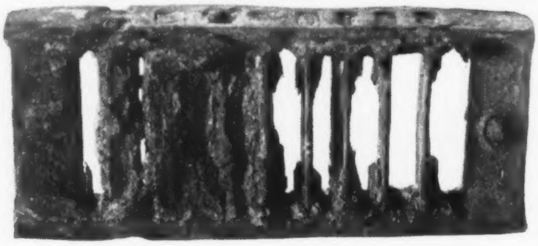
This advertisement is based on facts from Lowe Brothers industrial case history files.

LEADERSHIP THROUGH CONSISTENT SERVICE

Lowe Brothers
FINISHES FOR INDUSTRY



Here's a before and after photo of a test rack of different alloys. The "after" photo (below) shows how the alloys reacted with exposure to high-temperature corrosion in this particular test. It's through tests like this that Inco's High-Temperature Corrosion Engineers are able to determine the material to recommend for special operating conditions.



What's Your High-Temperature Problem?

Inco High-Temperature Corrosion Engineers want to help you solve it.

Anyone working with the higher operating temperatures has undoubtedly run into the common problem of equipment failure.

Engineers have found that corrosion quickly spells death to many metals when the temperatures mount.

That's why Inco established a special High-Temperature Engineering Service to search out and determine what materials would stand up best under unusual corrosive conditions at high temperatures.

You can see some of the results of their tests in the heat-treating, glass, chemical, petroleum, aeronautical and power industries when you visit the National Metals Exposition at Convention Hall in Philadelphia, October 20-24. Inco's booth is 324; drop around and visit. There'll be Inco High-Temperature engineers on hand to discuss your problem with you.

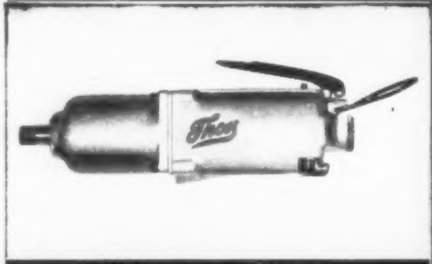
They may have the answer you are looking for – if not, you can be sure they will attempt to get it as soon as possible.

So remember Inco's booth number – 324 – at the National Metals Exposition.

Or, send today for your free copy of the High-Temperature Work Sheet. It is a specially developed simplified form to aid you in setting down your problem so that our engineers can go to work on it.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

NOW. . . A COMPLETE Thor AIR

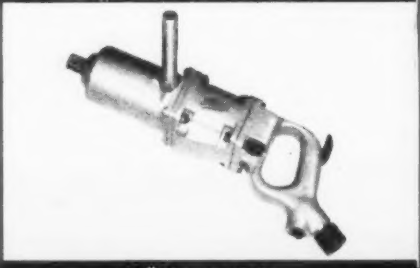


¼" Capacity, 4 Models
Offset or Lever Handle

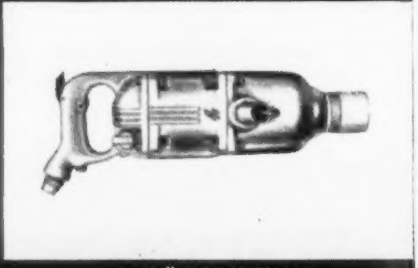
⅜" Capacity, 4 Models
Offset or Lever Handle

⅝" Capacity, 4 Models
Side or End Grip Handle

¾" Standard Duty, 2 Models
Side or End Grip Handle



¾" Heavy Duty
Grip Handle



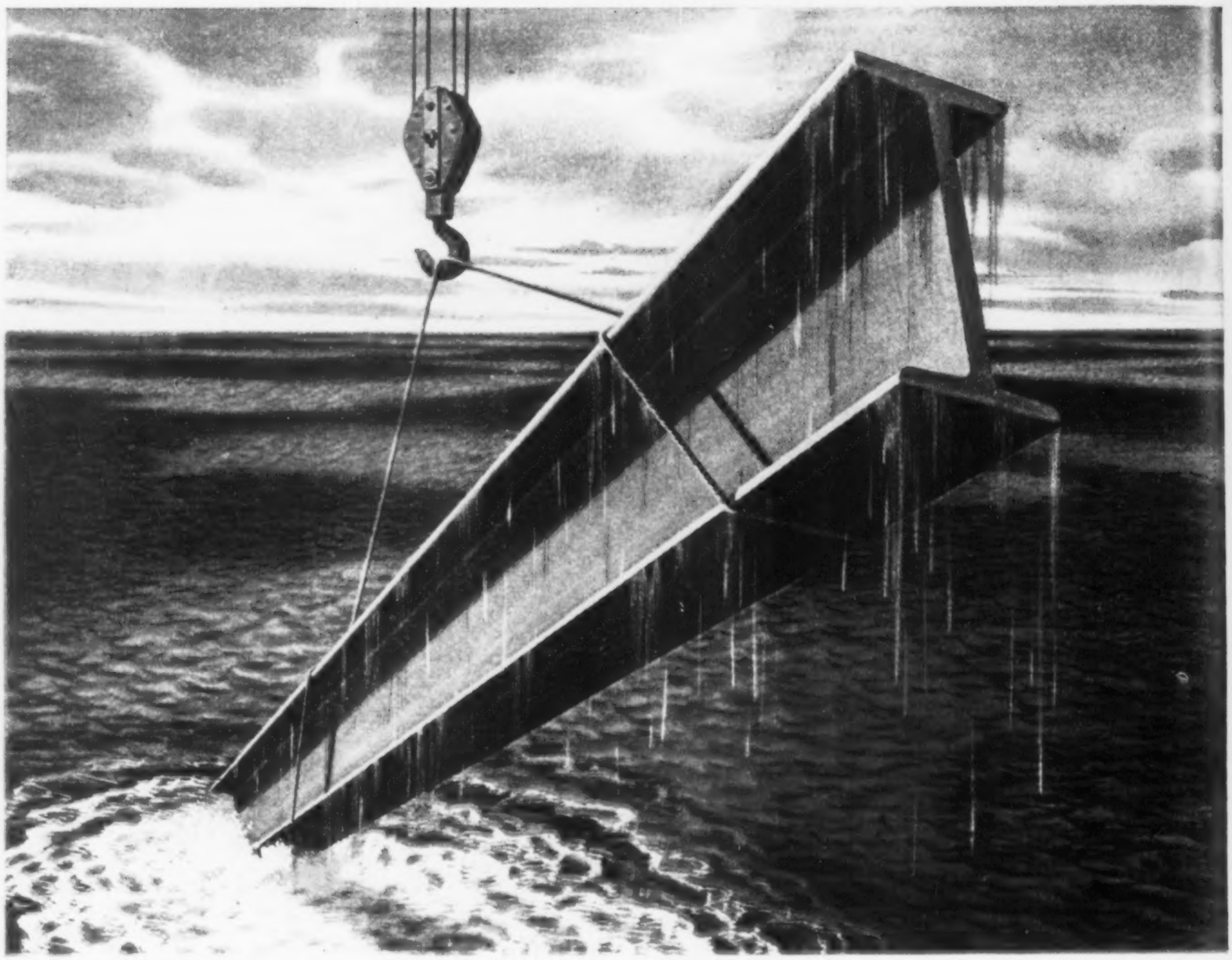
1¼" Heavy Duty
End Grip

SPECIFICATIONS

ON THE NEWEST, HARDEST-HITTING AIR IMPACTS AVAILABLE TODAY!

Optional square drive spindle or quick change chuck (integral with spindle) on sizes up to ¾" Heavy Duty.

TOOL SIZE	BOLT SIZE CAPACITY	WEIGHT POUNDS	TYPE THROTTLE HANDLE	LENGTH OVERALL	SPINDLE SQUARE
16	¼"	3-⅝	OFFSET	7-⅝"	⅜"
16S	¼"	3-13/16	OFFSET	8-11/16"	—
16L	¼"	3-½	LEVER	8-⅜"	⅜"
16LS	¼"	3-11/16	LEVER	8-7/16"	—
24	⅜"	5-¾	OFFSET	8-11/16"	½"
24S	⅜"	6	OFFSET	9-13/16"	—
24L	⅜"	5-⅜	LEVER	10"	½"
24LS	⅜"	5-9/16	LEVER	11-⅝"	—
40	⅝"	12-¾	OFFSET	10-½"	⅝"
40S	⅝"	13	OFFSET	11-⅝"	—
40G	⅝"	13-½	END GRIP	15-5/16"	⅝"
40GS	⅝"	13-⅞	END GRIP	16-7/16"	—
48	¾"	13-½	OFFSET	11"	¾"
48G	¾"	14-½	END GRIP	15-½"	¾"
48HG	¾"	20-¼	END GRIP	18"	1"
20	1¼"	33-½	END GRIP	16-⅜"	1"



Sea water...secret of more steel!

THE secret of improved open hearth furnace bottom performance—and increased ingot production for you—is high purity periclase derived from sea water magnesia.

Higher in MgO, lower in impurities, this sea water *periclase* is the heart of Permanente 165 ramming mix.

Proved superior by many of the industry's most progressive companies, Permanente 165 *retains highest strength at operating temperatures*—gives maximum refractoriness and maximum resistance to chemical attack.

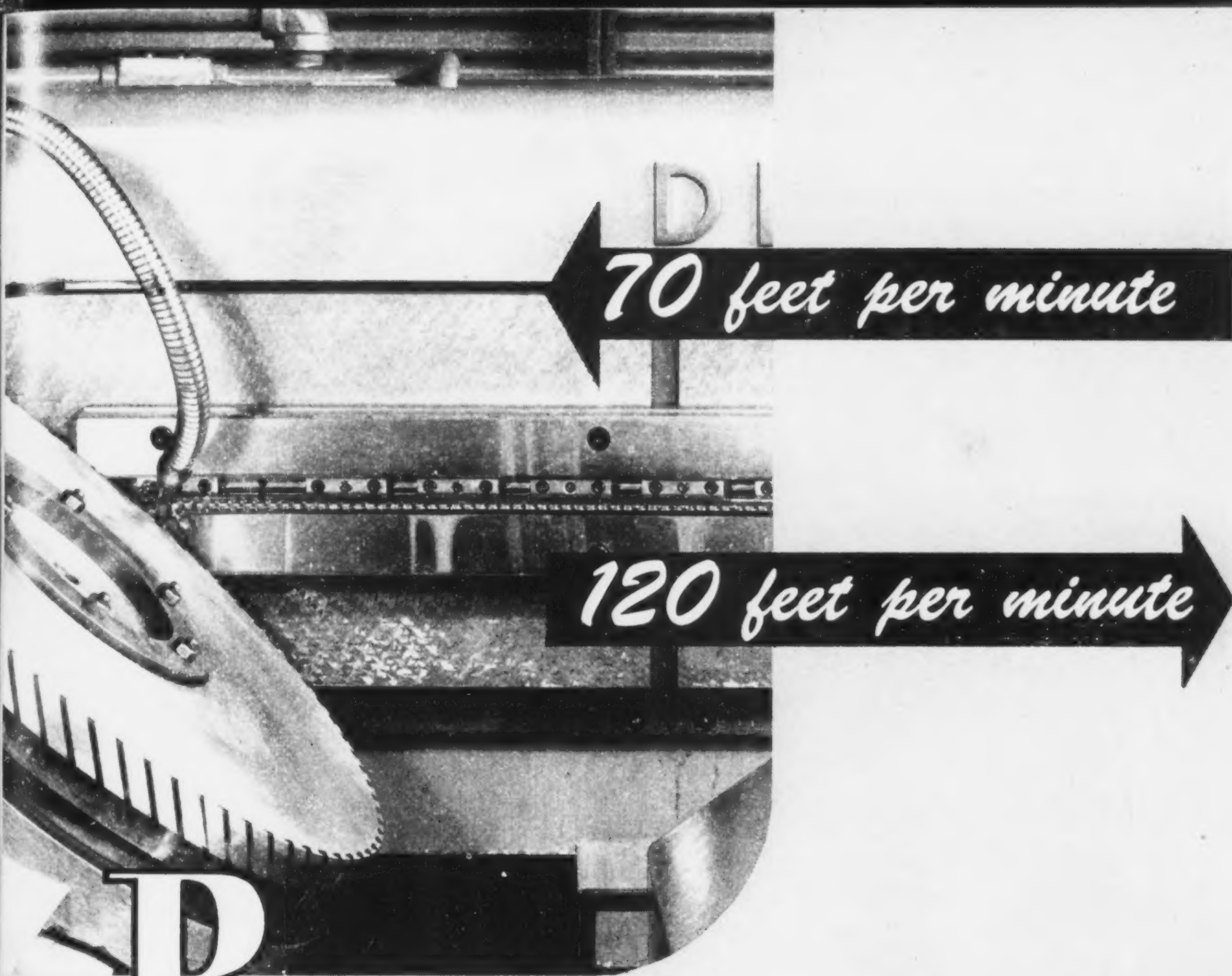
Pre-shrunk for high density, the sea water periclase of patented Permanente 165 is bonded to *full depth* by crystal bridging—a solid phase reaction. Result: protection from costly breakthroughs, less down-time for repairs between heats, more tonnage per year!

YOUR Kaiser refractory engineer will give prompt attention to your refractory problem—will offer, where desired, research, design and installation service to give you maximum production most economically. Write for descriptive literature on Permanente 165 and on the companion ramming mix, Permanente 84. Principal sales offices: *Chemical Division*, Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California. First National Tower, Akron 8, Ohio.

Kaiser Chemicals

Pioneers in Modern Basic Refractories

Basic Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Alumina • Periclase


70 feet per minute
120 feet per minute

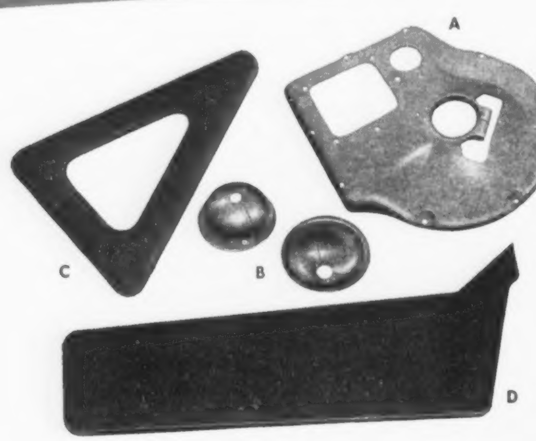

coolants and lubricants for MACHINING
drawing lubricants for FORMING
compounds for metal CLEANING
core oils for CASTING
salts and quenching oils for HEAT TREATING
LET HOUGHTON HELP YOU GET MORE
inhibited coatings for RUST PREVENTION
NEW HOUGHTON PROCESSING AIDS
☐ Want a single water soluble cutting base that will handle 90% of all machining jobs?
☐ Or, an additive for water used in grinding, that will inhibit against rust?
☐ Or, a rust preventive film so thin you can't see it, yet protective for such long periods?
☐ Or, a quenching oil faster in quenching speed than any oil medium yet developed for lean alloy steels?
☐ Or, a phosphate cleaner that cleans and protects . . . aids paint adherence?
Check any item on which you want full data, sign in the margin of this page, and mail to E. F. HOUGHTON & COMPANY, 303 W. Lehigh Ave., Philadelphia 33, Pa.

CATERPILLAR TRACTOR CO.

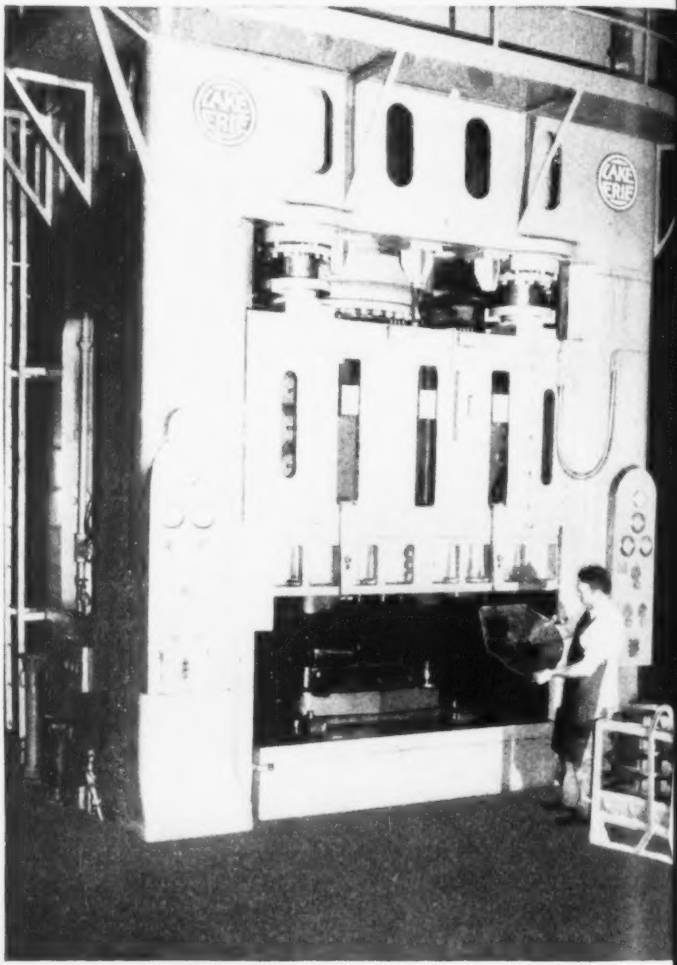
demonstrates the **wide applications**

of Lake Erie Hydraulic Presses

A good example of the great variety of money-saving opportunities for hydraulic presses in the modern metal working plant.



TYPICAL PIECES FORMED ON PRESSES. (A) Steel cover 35″ long, 26″ wide and 7/32″ thick is blanked and drawn in a single operation with 1200 tons pressure. Cover is pierced, trimmed and restruck on smaller hydraulic press after blanking and drawing. (B) King bolt liners formed out of .134″ hard brass are 8″ in diameter. Pieces are blanked, drawn and coined on the 500 ton Lake Erie press. (C) Earth-moving bulldozer lifting crank 24″x24″x12″ outside, 12″x12″x10″ inside x 1″ thick blanked in a single operation. (D) Blank for earth-moving bulldozer end plate is 10″ wide at one end, 12″ at other. 54″ long and 7/8″ thick.

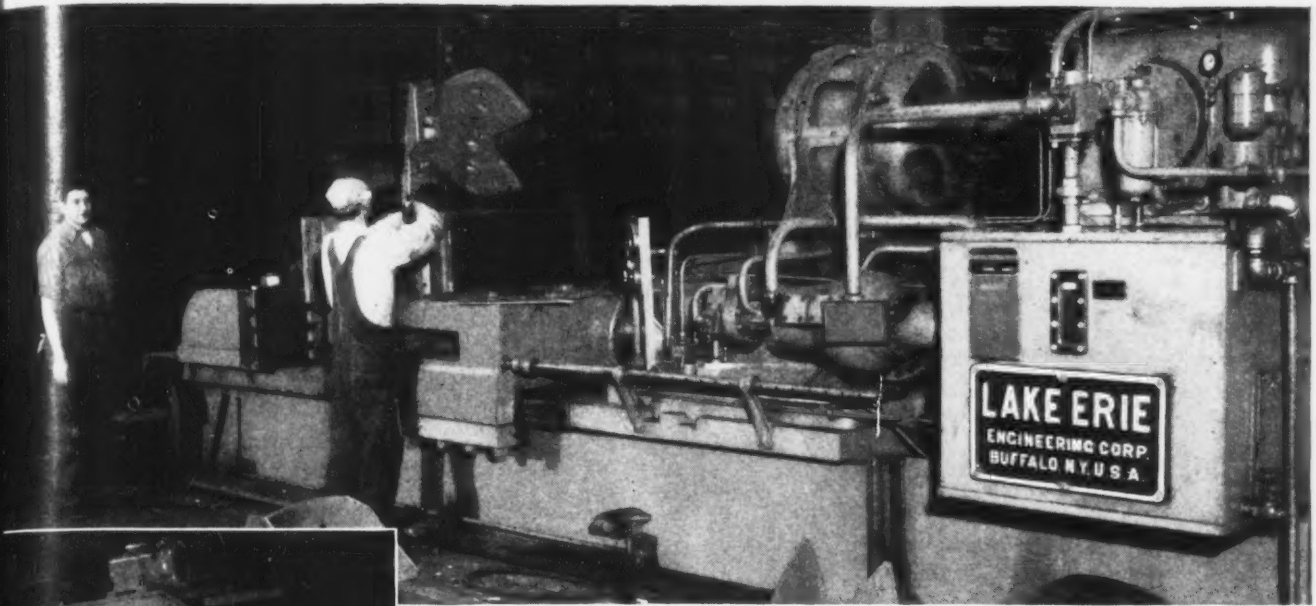


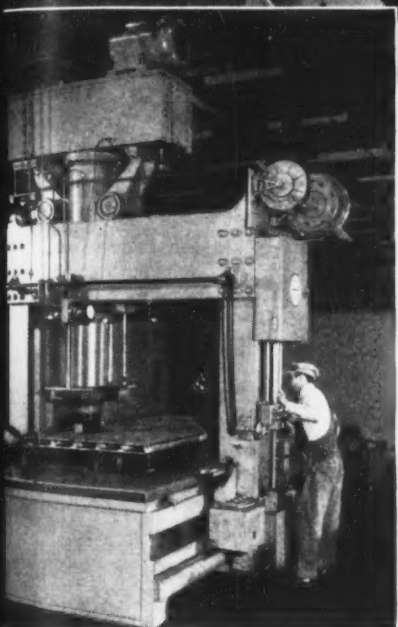
2000 TON DOUBLE ACTION PRESS.

This press has a 500 ton hydro-pneumatic die cushion, bed size of 96″x96″ and daylight opening of 60″. It is used generally for forming large pieces requiring high tonnage, but is also used for heavy blanking jobs.

750 TON SINGLE ACTION PRESS *left* **—500 TON DOUBLE ACTION** *right.*

These presses are used for a wide variety of forming operations including blanking, bending, drawing, piercing and coining. The pieces illustrated at left above are a few examples of the work done on the three presses shown on this page.



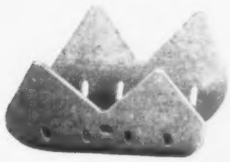


500 TON HYDRAULIC BULLDOZER.

This widely-used horizontal press is shown hot forming draft frame reinforcements. Pieces are ⅜" thick, 30" wide and approximately 4' long before bending. A pressure of 400 tons is used.

200 TON TRAVELLING HEAD STRAIGHTENING PRESS.

A versatile, highly accurate press that is very much in demand. Used to straighten all types of weldments such as bulldozer blades and other large weldments, some of which appear in lower right corner of photo.



The piece shown above is another example of hydraulic bulldozer work. It illustrates draft frame bottom plates which are hot formed from ⅜" thick stock 7½' long before bending. Draft frame reinforcement also formed on hydraulic bulldozer is shown at left.

THE ABILITY OF LAKE ERIE HYDRAULIC PRESSES to perform a multitude of production jobs that save time and money, simplify design and assembly, and result in a better product for the manufacturer is amply demonstated at Caterpillar Tractor Co. A carefully selected group of Lake Erie hydraulic presses is busy doing a wide variety of metal forming work. This includes hot and cold bending, drawing, straightening, blanking, piercing, coining, and many other operations, a few of which are illustrated on these pages.

It is hard to conceive of a metalworking plant today that wouldn't benefit immensely through the use of one or more of these hydraulic presses—possibly a hydraulic bulldozer... or a straightening press... or a single action press with die cushion... or some other type or combination of presses. Why not discuss this possibility with our engineers? We have developed more than 3,500 designs for hydraulic presses to meet practically all needs. We serve the leaders throughout industry with complete satisfaction. We can do it for you. Write or phone today.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

General Offices and Plant:

368 Woodward Avenue, Buffalo 17, New York

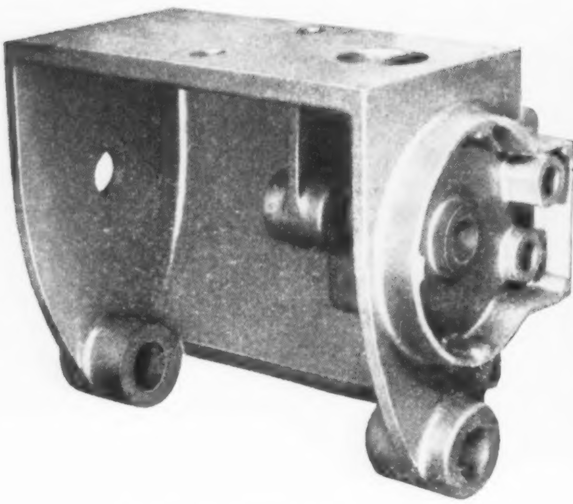
DISTRICT OFFICES IN NEW YORK, CHICAGO and DETROIT

Representatives in Other Principal Cities in the United States and Foreign Countries

Manufactured in Canada by: Canada Iron Foundries Limited

LAKE ERIE HYDRAULIC PRESSES are available in any size . . . standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Die Casting—Briquetting—Baling—Special Purpose. LAKE ERIE ®

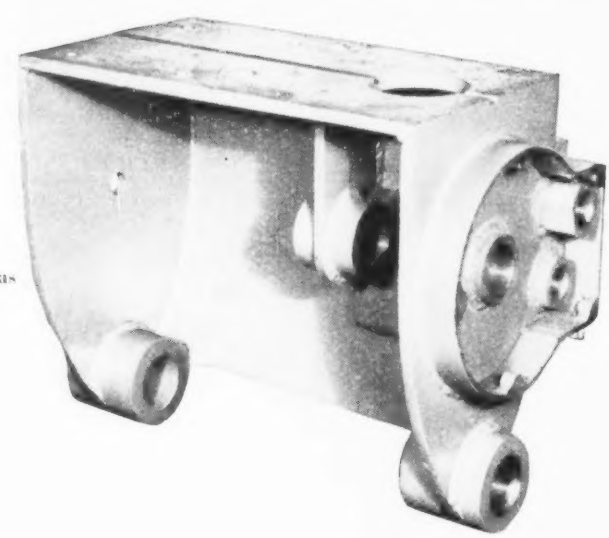
Designers and builders of the most complete line of Hydraulic Presses for the manufacturing industries



45% SAVED...
on original cost of part

41% SAVED...
on machine and labor expense

Gearbox for power-driven saw, as cast in Gray Iron.



Fabricated gearbox, which was replaced by the cast design.

By redesigning in Gray Iron, it is often possible to effect substantial cost savings. Here is a striking example:

> The manufacturer of a large power-driven metal saw found that the cost of a fabricated gearbox (right above) was out of line from a competitive standpoint. Designs for a suitable Gray Iron casting were requested and approved. Result:—the Gray Iron casting is effecting a saving of 45% on original cost of the part, plus a saving of 41% on machine and labor expense.

Doesn't this suggest that it's time to analyze *your* costs on certain fabricated parts—with a view to producing them better and more economically in Gray Iron? Write for technical information on the many advantages of the Gray Iron casting process.

GRAY IRON
Characteristics Include:

- Castability
- Rigidity
- Low Notch Sensitivity
- Wear Resistance
- Heat Resistance
- Corrosion Resistance
- Durability
- Vibration Absorption
- Machinability
- Wide Strength Range

Make it Better with Gray Iron • **Second largest industry in the Metal-working field**

GRAY IRON FOUNDERS' SOCIETY, INC.

NATIONAL CITY-E. 6th BLDG., CLEVELAND 14, OHIO

You're always right with AUTO-LITE Die Castings

● Many of America's leading manufacturers, producing a wide variety of products, are benefiting from Auto-Lite die cast research, experience and advancement. Such developments as high pressure casting, special alloying practices and improved quality through the "controlled metals process" make Auto-Lite the logical source of supply for precision die castings. Address inquiries to:

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Die Casting Division
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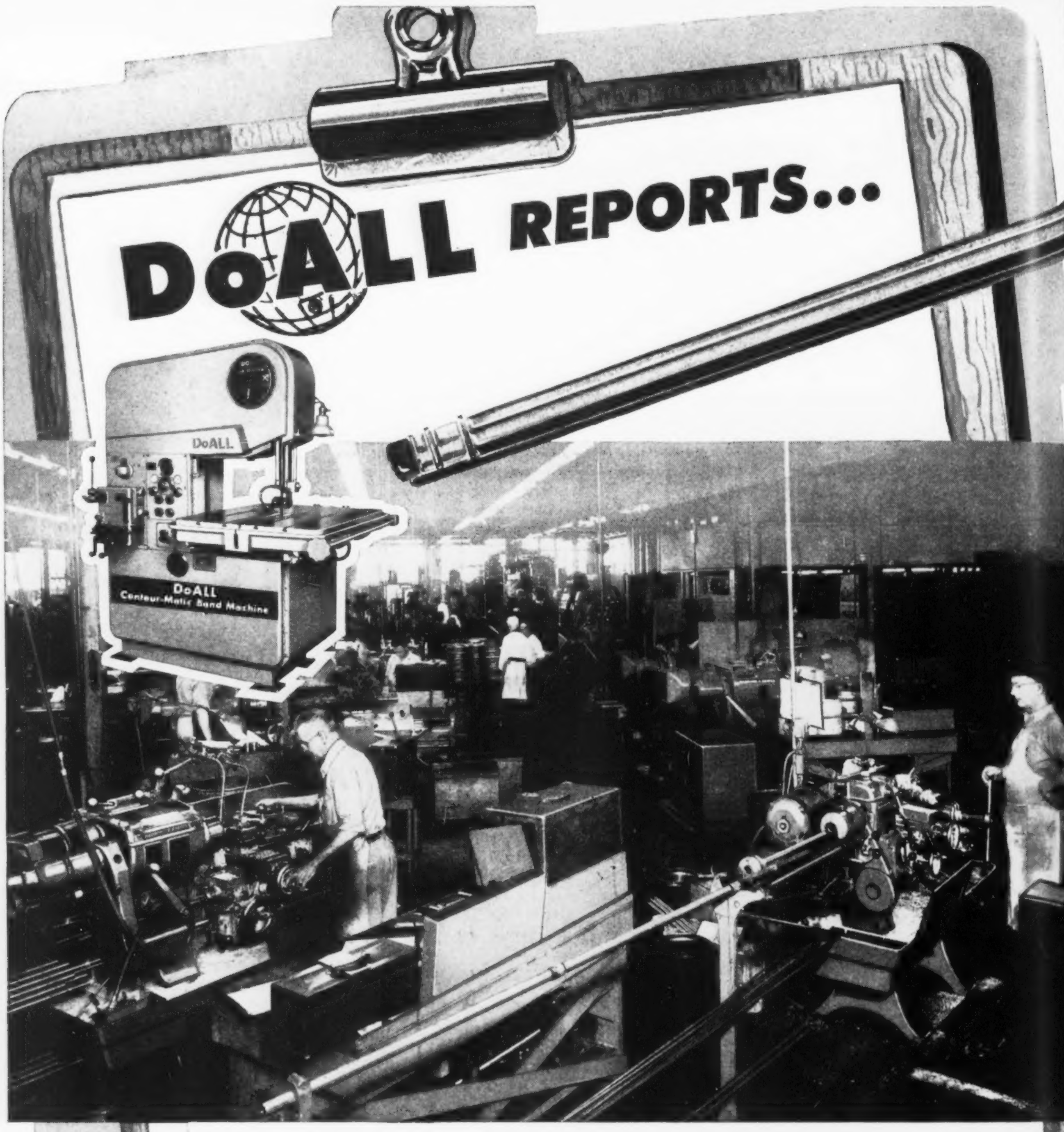
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Contour-Matic Band Machine

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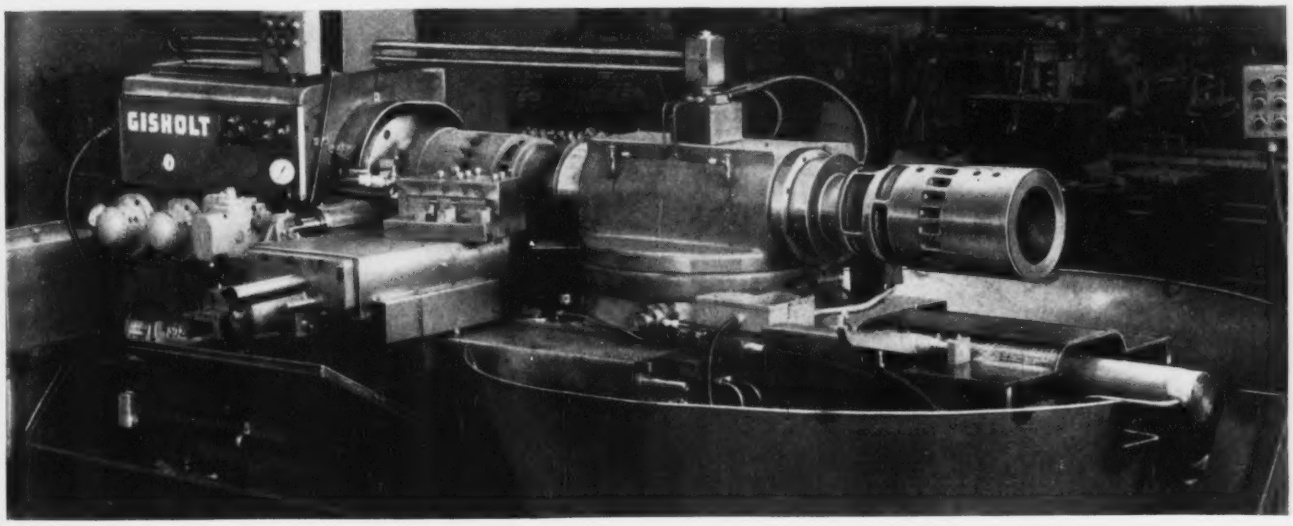
Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to machine shops, we hope some of these interesting ideas, culled from thousands of jobs, will suggest ways to help you cut time and costs in your own metal work.



No. 24 Hydraulic Automatic Lathe with special turret having two mandrels.

PIVOTING MANDRELS END LOADING TIME LOSS

No. 24 Hydraulic Machines One Part While Another Is Loaded

In this interesting production pointer, loading time is actually part of *machining* time—with one workpiece being put on the lathe or taken off while another is being machined.

The part is a diesel engine cast-iron cylinder liner and the machine is a No. 24 Hydraulic Automatic Lathe which has two identical expanding mandrels on an indexing carriage. Twin arbors are mounted 180° apart with ratchet teeth for driving.

Single Automatic Operation

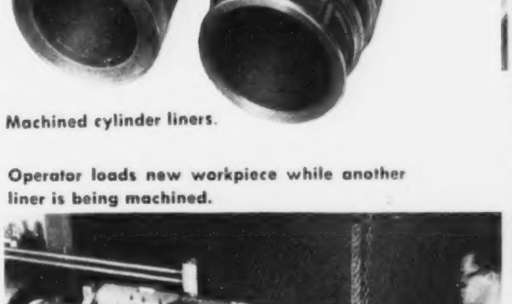
The automatic cycle begins with carriage moving forward until the arbor engages driving teeth in the spindle nose. This brings in the front and rear slides carrying a total of 28 tools which machine all outside diameters, faces and chamfers. With cuts completed, the tool slides retract, the work carriage traverses back and automatically indexes the new workpiece into position.

This feature achieves important savings in time and added production. With a finished liner being unloaded and new workpiece put in place *during* machining, loading and unloading time are absorbed in the machining cycle. Hence, the machine spends most of its time making chips. The only lapsed time between machining is for traversing up, back and for indexing—less than half a minute! Machining time for this liner—and other sizes handled on other No. 24 Hydraulics—is below 3 minutes . . . good reason why this manufacturer standardizes on the efficiency of the No. 24 Hydraulic Automatic Lathe for these operations.

With Twin Mandrels This No. 24 Hydraulic Provides Continuous, Fast Production with No Lost Loading Time.

Machined cylinder liners.

Operator loads new workpiece while another liner is being machined.



TIME-SAVING IDEAS

A ONE-MAN, TWO-MACHINE TEAM

Gear Blank Savings Are "Automatic"

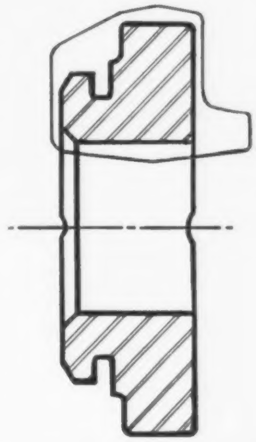
It's a case of perfect teamwork . . . the way these two 2F Fastermatic Automatic Turret Lathes turn out gear blanks. Splitting the job accounts for important savings in time, money.

First machine: With the steel forging held on the chucking hub, three passes are taken through the bore and two passes across the face, then rough turn and chamfer—all handled from the turret. Rough and finish grooving is done by tools on the independent front and rear cross slides. Time: 5 minutes.

Second machine: Part is held in the bore while turret tools remove chucking hub, semi-finish and finish the various diameters and chamfer. The two cross slides complete the rough and finish facing. Time: 3 min.

Not only is gear blank production made fast by this two-machine setup, but it's planned for real economy with one operator tending both lathes. Moreover, with the chance for human error eliminated by the automatic operation of the Fastermatics, there's assured accuracy with true concentrics and parallels.

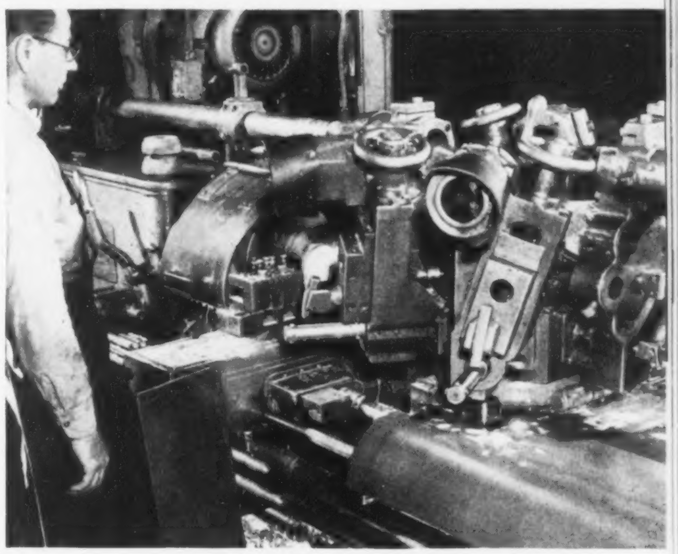
For gear blank work—or any kind that belongs on an automatic turret lathe, investigate the Fastermatic.



Operations required to finish gear blanks. Light line indicates rough forging.

Rough forging and completed blank.

On This Gear Blank Job, Operator Is Needed Only for Loading and Unloading—the Two Fastermatics Automatically Perform All Work.



First operations on gear blanks are performed by this Fastermatic.

PUTS FINISHING TOUCHES TO CRANKSHAFTS — *BUT FAST*

Simplimatic Does Neat Job on Counterweights

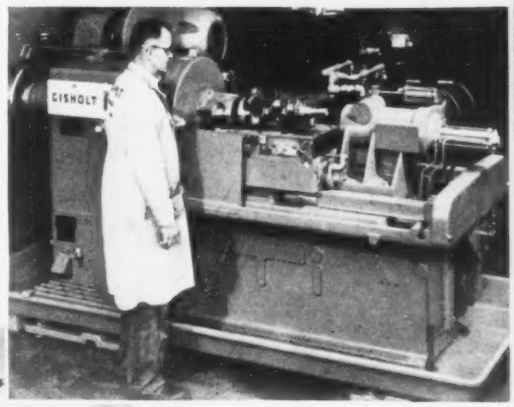
Crankshafts always make interesting machining jobs. On this one, for a V-8 engine, a Simplimatic Automatic Lathe takes care of the six counterweights. Here's the setup:

The 25½" crankshaft is held in a special pot-type chuck and driven from a slot in the flange. The oil seal bearing surface rests in a half bearing and is clamped with two jaws. There's a steadyrest at number three main bearing for support. Number one main bearing is held in a tapered, slip-fit bushing in the tailstock.

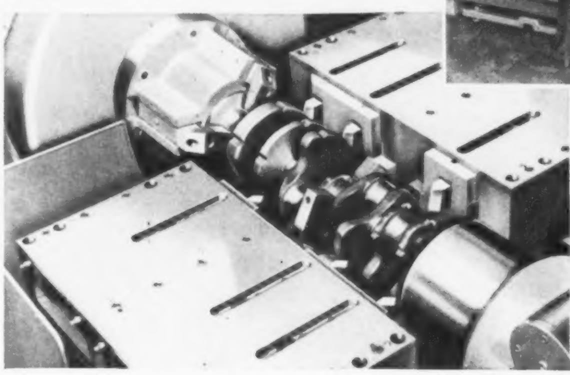
Three tools each in both the front and rear slides turn all six counterweights and generate chamfers ⅛" by 45 degrees. Floor to floor time is 1.66 minutes, using H. S. S. cutting tools. The sliding tool holders, a precautionary feature for this job, retract into master blocks after cycle is completed, thereby providing loading clearance and tool protection.

All Crankshaft Counterweights Are Turned and Beveled in a Single Automatic Operation by the Simplimatic.

JUST OFF THE PRESS!
An entirely new Simplimatic catalog is ready—complete with the information and specifications you want, pictures and job facts. Write today!



The Simplimatic with part ready for loading. Tool blocks at this point are retracted for clearance and tool protection.



Close-up of the workpiece and tooling. Note steadyrest for center main bearing.

EARMARK YOUR DEPRECIATION ALLOWANCES FOR NEW MACHINE TOOLS

TIME-SAVING IDEAS

HOW MAINTENANCE BALANCING PAYS FOR ITSELF

Southern Railway Company Adds Life to Diesel-Electric Equipment

Southern Railway Company is doing it, too. In its Pegram Repair Shop, Atlanta, they are getting even greater efficiency and performance from diesel electric locomotives—through balancing. A 6U DYNETRIC Balancer handles balancing in the maintenance of traction motors and generator armatures.

An example is this traction motor armature. Measuring 4 feet long and weighing 2500 lbs., dynamic unbalance is located and measured to an accuracy of ¼ ounce inch. Corrections are made by welding small steel blocks on the core while the armature is still in the balancing machine. A final check for accuracy and possible operator error is then made.

On this large electrical part, the entire operation—setup, loading, checking, correcting, rechecking and unloading—only requires about one hour. Yet, this accuracy of balance—with smoother, vibrationless operation and lessened bearing wear—pays off in far longer life between overhauls, returning balancing costs many times over.

If maintenance of electrical equipment is a problem of yours, ask for the article on balancing applications in railway shops. With it we will include the book *Static and Dynamic Balance,* which thoroughly covers the entire field of balancing.

ALL MATTERS OF BALANCING, *maintenance and production balancing are covered fully in the Gisholt Balancing School. Write for details, starting dates.*

Ready to check and correct unbalance in 2500 lb. armature.

Precision Balancing of Railway Electrical Equipment Greatly Reduces Frequency of Failure and Assures More Efficient Operation.

DYNETRIC BALANCERS

Dial indicates exact number of correction units required.

THE WAY TO BETTER CRANKSHAFTS—SUPERFINISH

Versatile Machine Handles Variety of Sizes

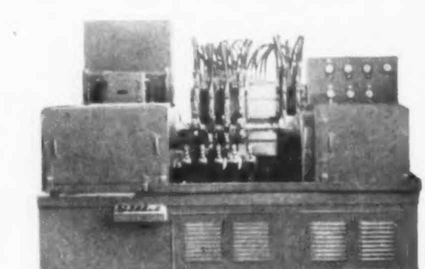
Even on diesel engine crankshafts, Superfinishing is a quick, inexpensive process.

This Superfinisher is a Model 77, arranged to do both pin and main bearings on a variety of 4 and 6 throw crankshafts. Four sets of stones in each of the upper stoneholder assemblies handle the pin bearings. Lower assemblies each have two sets of stones for the main bearings.

Crankshafts come to the Superfinisher with rough ground bearing surfaces of 20-30 micro inches. After a 2.3 minute automatic cycle, surfaces measure 4-5 micro inches. What this finer smoothness means in greater crankshaft performance is obvious—grinding chatter marks and smear metal are removed, there's improved geometry, added smoothness and longer bearing life.

See how your own problems can be solved by Superfinishing. Write for your complimentary copy of "*Wear and Surface Finish.*"

Superfinishing These Crankshaft Bearings Not Only Assures Longer Lasting Surfaces, but It Also Cuts Grinding Time and Costs.



Model 77 Superfinisher for 4 and 6 throw crankshafts.

Close-up showing upper and lower stoneholder assemblies for Superfinishing pin and main bearing simultaneously.

No. 9-1052

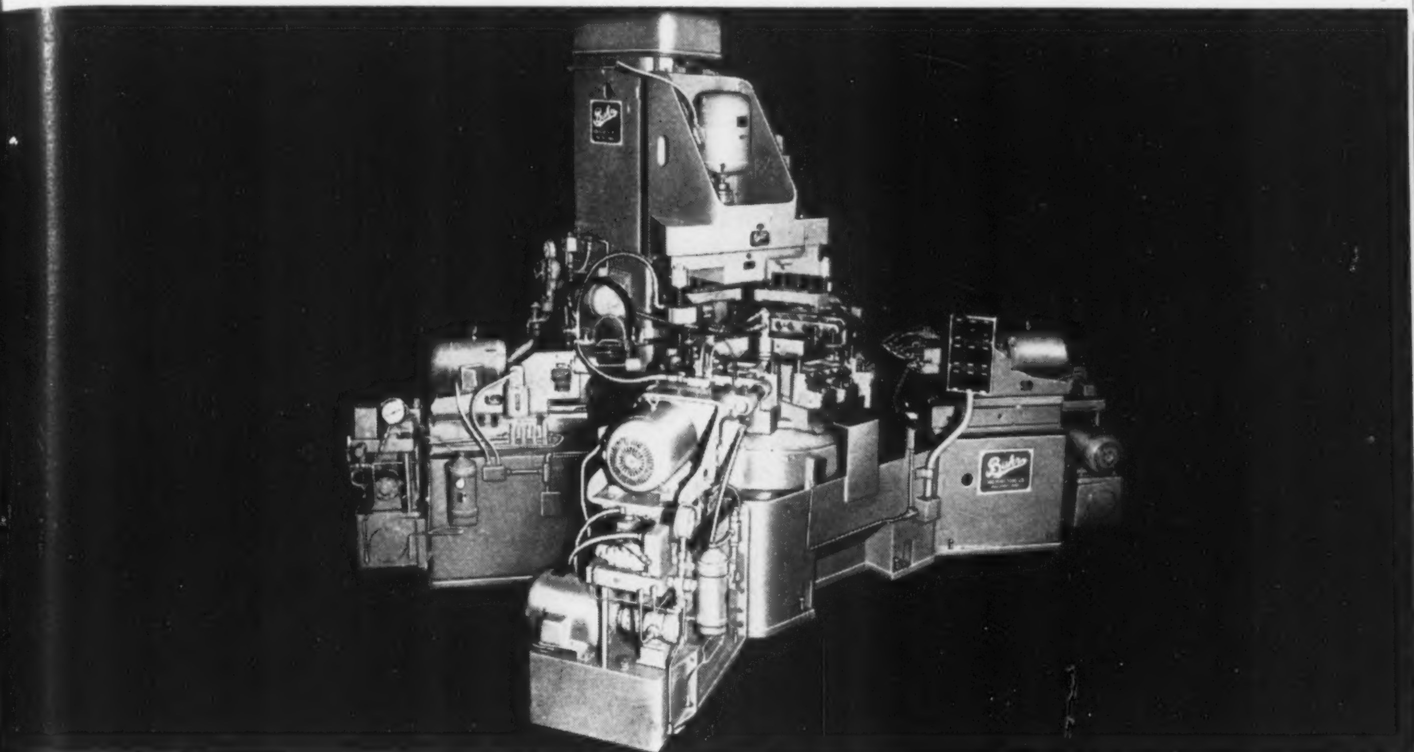
599

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

WHY DOAKES GETS FROM BANFF TO TALLAHASSEE



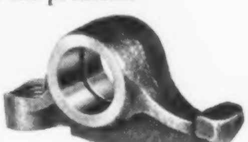
What are the travel and automobile agencies reporting every season? . . . That Joe Doakes—the typical American—is taking more vacation and traveling farther year after year . . . And here's one of the reasons why—this Buhr Five-Way Horizontal-and-Vertical Hydraulic-Feed Drilling Machine . . . the Machine which one of the world's leading Auto Makers uses "around the clock" for producing Rocker Arms in such volume and at such low cost that . . . Joe Doakes may afford to drive thousands of miles for vacations —literally from Banff in west Canada to Tallahassee, Fla.

Auto Maker Chooses This to Turn Out 880 Pieces an Hour for Utmost Economy

As each new model comes off the auto assembly lines, the battle to cut production costs becomes more intense. Not long ago, one of the big auto companies concentrated on how to make a certain rocker arm most economically.

Here Was Their Problem

To secure a piece of production equipment which would perform 7 operations on the rocker arm, including tapping, drilling, endmilling, chamfering and spotfacing—that was the problem.



As the company to design and manufacture the Special Machinery to solve this problem, they chose Buhr.

What the Machine Does

In general—it drills 8 holes, drills through 4 more holes, taps 4 holes, endmills 4 places, spotfaces 4 places and chamfers 4 previously drilled holes. It is equipped with 42" automatic Index Table and six-station Holding Fixture, loading four parts per station. Parts are automatically clamped while fixture moves from loading position into first working station, and are automatically unclamped while Fixture moves from last working station to unloading.

Specifically, the Machine does this—

Station 1—Load and Unload

Station 2—Vertical, idles; Horizontal, taps and drills (4) $\frac{7}{16}$-20 holes

Station 3—Vertical, endmills (4) $\frac{1}{2}$" Radius places; Horizontal, chamfers (4) previously drilled holes

Station 4—Vertical, drills (4) $\frac{1}{8}$" dia. holes $\frac{5}{16}$" deep; Horizontal, idles

Station 5—Vertical, drills (4) $\frac{3}{32}$" dia. holes through; Horizontal, spotfaces (4) $\frac{15}{16}$" dia. places

Station 6—Vertical, idles; Horizontal, taps (4) $\frac{7}{16}$-20" S.A.E. holes

PRODUCTION—880 pieces per hour at 100% efficiency.

Why Buhr Was Called In

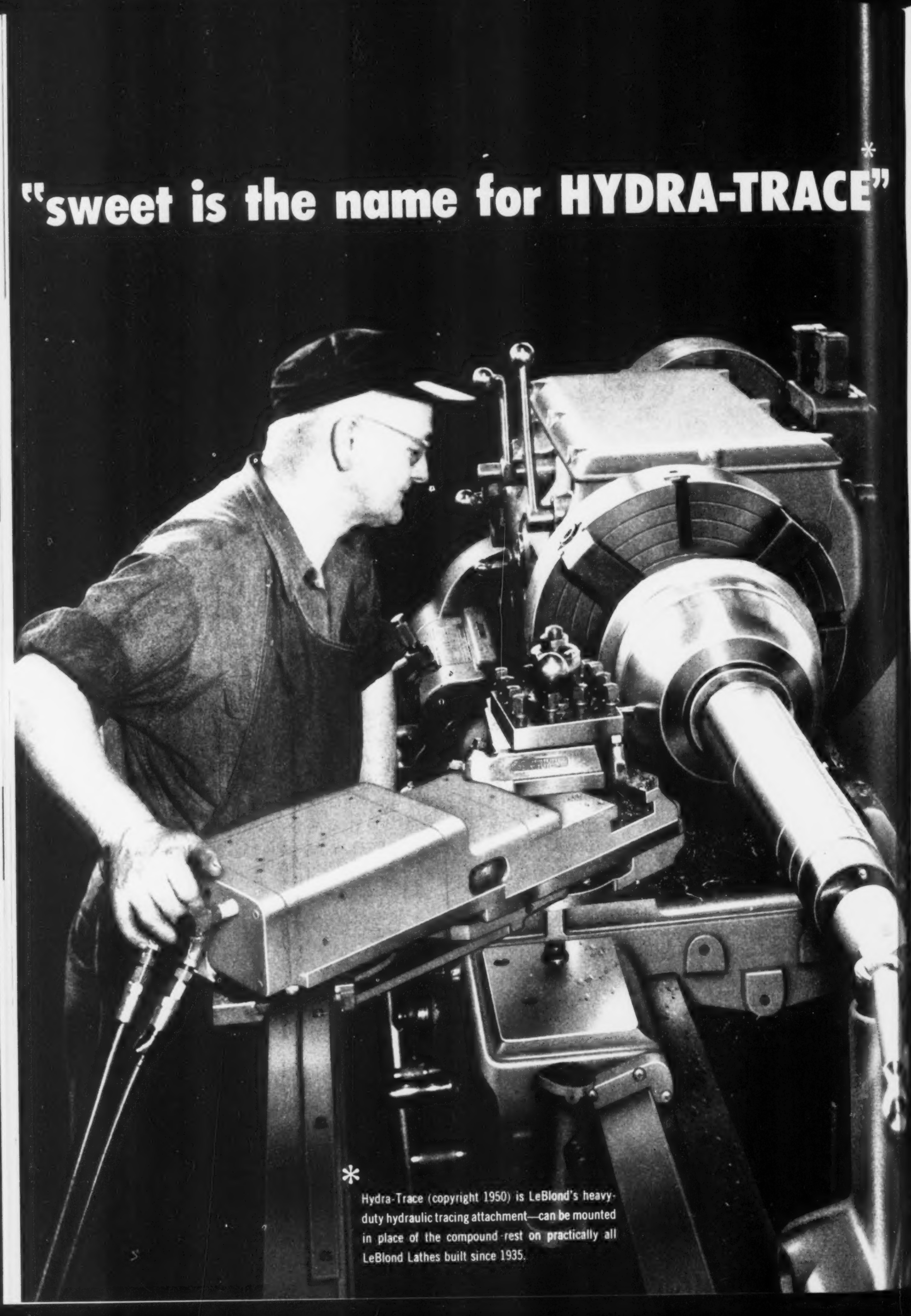
Leading Automobile Manufacturers have done business with Buhr for more than a quarter-century. . . . They know Buhr's record for dependable Special Machinery . . . and for delivering on time. . . . They're familiar also with Buhr's excellent manufacturing facilities . . . and their experienced, trustworthy and specialized sales and engineering staffs. Consequently . . . for Special Machinery like this . . . it is second-nature for them to call Buhr.

For Details About Buhr

A comprehensive Catalog . . . or a personal call from a Buhr Sales Engineer . . . is yours for the asking wherever you are located in the United States! . . . For every problem involving this type of Special Machinery—including the type which helps Joe Doakes get from Banff to Tallahassee—phone, wire or write us.

BUHR MACHINE TOOL CO.
Ann Arbor, Michigan
Phone: Ann Arbor 2-5646—5980
Detroit WOodward 3-2126

Buhr **SPECIAL MACHINERY . . . *Leaders Make Sure with BUHR***


"sweet is the name for HYDRA-TRACE*"
*
Hydra-Trace (copyright 1950) is LeBlond's heavy-duty hydraulic tracing attachment—can be mounted in place of the compound rest on practically all LeBlond Lathes built since 1935.

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COMPLETE!
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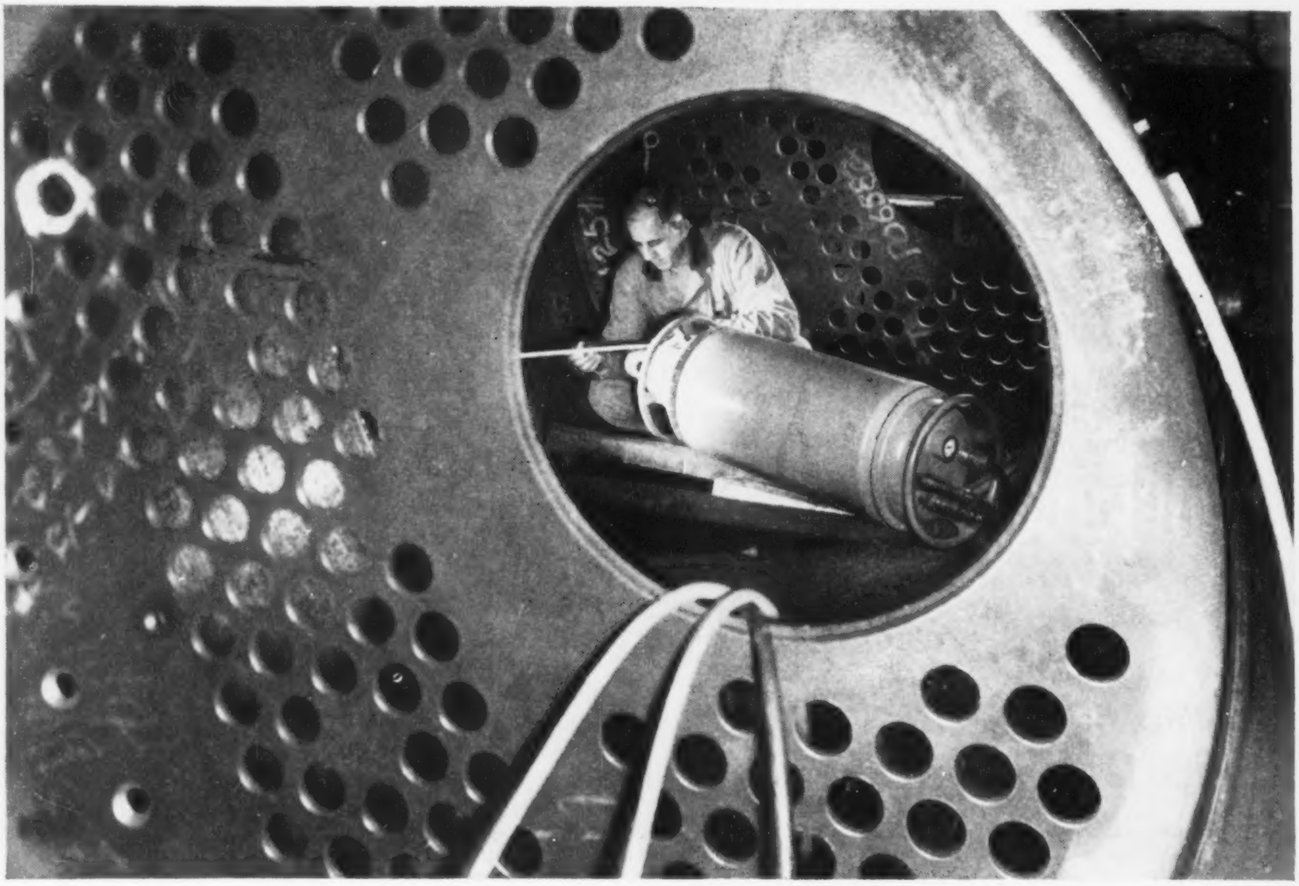
NOW — a *truly* portable industrial x-ray unit!

The General Electric RESOTRON 250



Compact, lightweight, 250,000-volt x-ray unit speeds inspection of large structures, saves many hours of set-up time

For radiographic examination of welds or castings in large structures, the new GE Resotron 250 offers unprecedented advantages. Completely housed in a cabinet only 4 x 6 x 4-foot high, which may be trailer-mounted, this unit can be set up anywhere in a few minutes by one or two men.

Small, lightweight tube head can be passed through a 15-inch diameter opening for interior inspection of large vessels. It's particularly adapted for ship hulls, pressure vessels, steam pipes. No cranes or elaborate rigging needed — can be manipulated manually.

Resotron 250 is the latest addition to the complete GE line of industrial x-ray apparatus . . . ranging up to 2,000,000-volt units and betatrons. It is actually a miniature of the famous General Electric million-volt Resotrons, with such time-proven features as resonant transformer, cascade tube and gas insulation.

Have you inspection problems the Resotron 250 might solve? See your local GE x-ray representative. Or write X-Ray Department, General Electric Company, Milwaukee 1, Wis., Rm. AR-10.

GENERAL ELECTRIC


W. FISHER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PRECISION BORING
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GE

A Program for 30 million new Americans

LISTEN to the voices of 30 million new Americans. They are answering the pessimists who say we are threatened with depression because we can't keep our farms and factories busy.

Let these pessimists read the future in the census returns. There is a tremendous upsurge in our population. Last year nearly 4 million babies were born. By 1960 we shall total 170 million people--30 million more than when war ended in 1945. This adds to our domestic market more people than there are in Canada and Australia combined.

Providing for these 30 million new Americans can keep our production machinery going at capacity. They call for new hospitals, schools and churches. Larger families need bigger houses to replace postwar houses that are too small now. More and bigger families need improved home equipment and more new automobiles. In short, to maintain and improve living standards for our children, we must work harder than ever before. To supply the needs of our 1960 population, including adequate national defense, it is estimated that the productivity of the individual worker must increase at least 30%, with additional investment of over 200 billion dollars in capital facilities.

There should be no room in this picture for depression. But we must have economy in government, elimination of waste and extravagance and a reduction of taxes and public debt. If we encourage private incentive, thrift and investment, we can bring about the greatest advance in health, wealth and happiness that America has ever known.

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MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

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No ONE chain serves every purpose

LINK-BELT offers the right chain

. . . engineered for your requirements

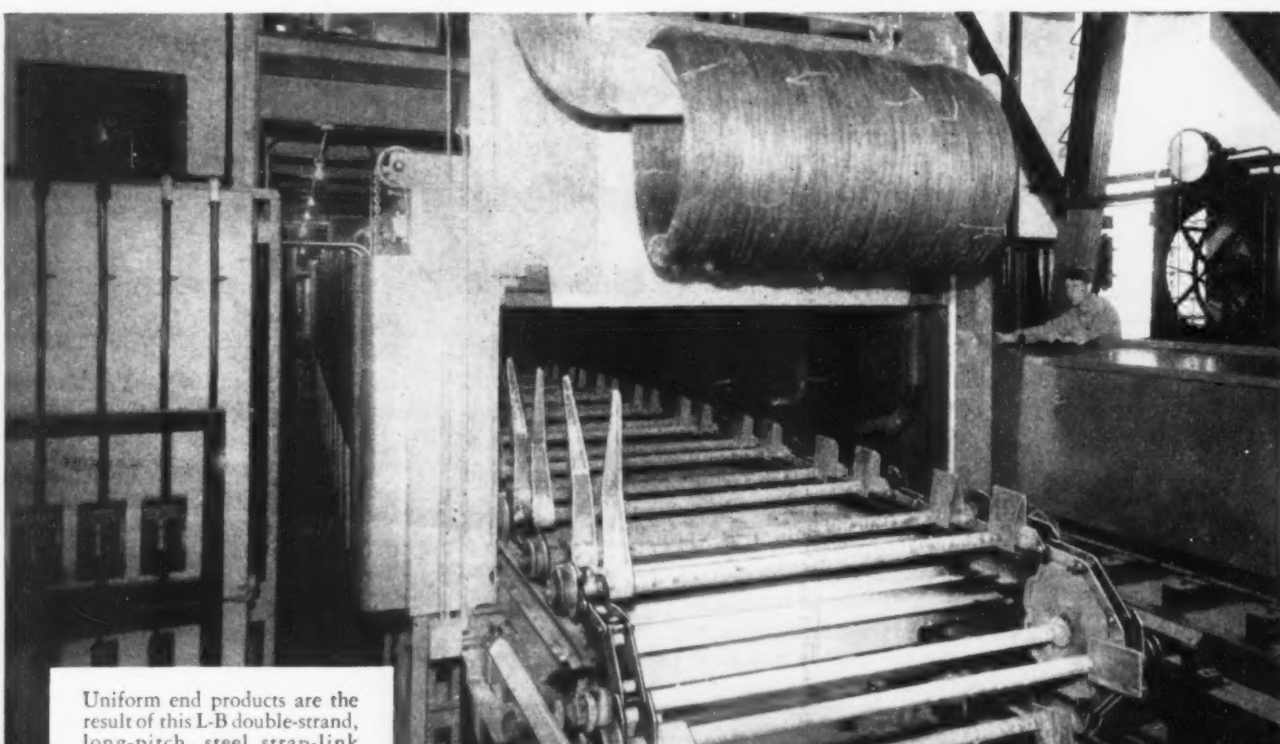
Don't settle for a "cure-all" chain to handle every job. Different types of chain have different characteristics. That's why Link-Belt makes a complete line of chains. Our engineers can recommend the correct type of chain to fit your particular needs . . . the one that does your job best.

Equally important is your assurance that *any* chain with the Link-Belt name will give you longer chain life. Accurate control of raw materials and processes . . . plus manufacturing refinements add up to the highest standards.

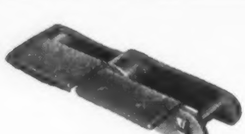
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, factory branch stores and distributors in principal cities. 12,731

LINK-BELT

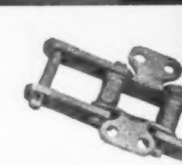
CHAINS AND SPROCKETS



Uniform end products are the result of this L-B double-strand, long-pitch, steel strap-link chain conveyor carrying 3000-lb. coils through rod baker.



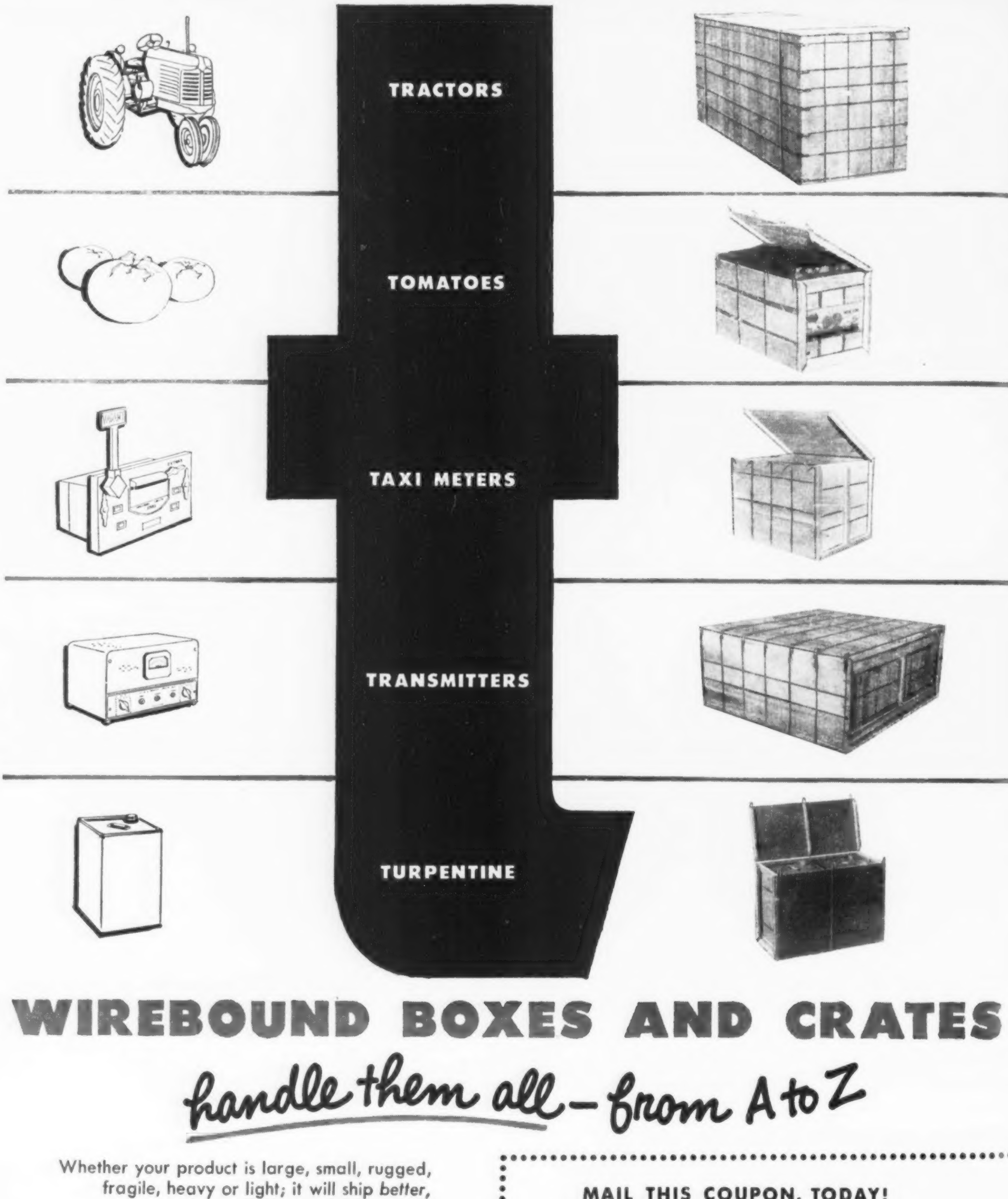
Class SS bushed roller chain with straight sidebars—for practically any conveying or elevating service.



Class C combination chain — popular, durable, low cost design for elevators and conveyors.

Class SS bushed roller chain with offset sidebars—for heavy drive service at moderate speeds.

Transfer chain with tilting dogs—for plate and slab travel, loads up to 300,000 pounds.



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handle them all—from A to Z

Whether your product is large, small, rugged, fragile, heavy or light; it will ship *better*, safer and more economically in a Wirebound Container.

Prove it to yourself!

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BOXES & CRATES

wood and steel for strength and resiliency

MAIL THIS COUPON, TODAY!

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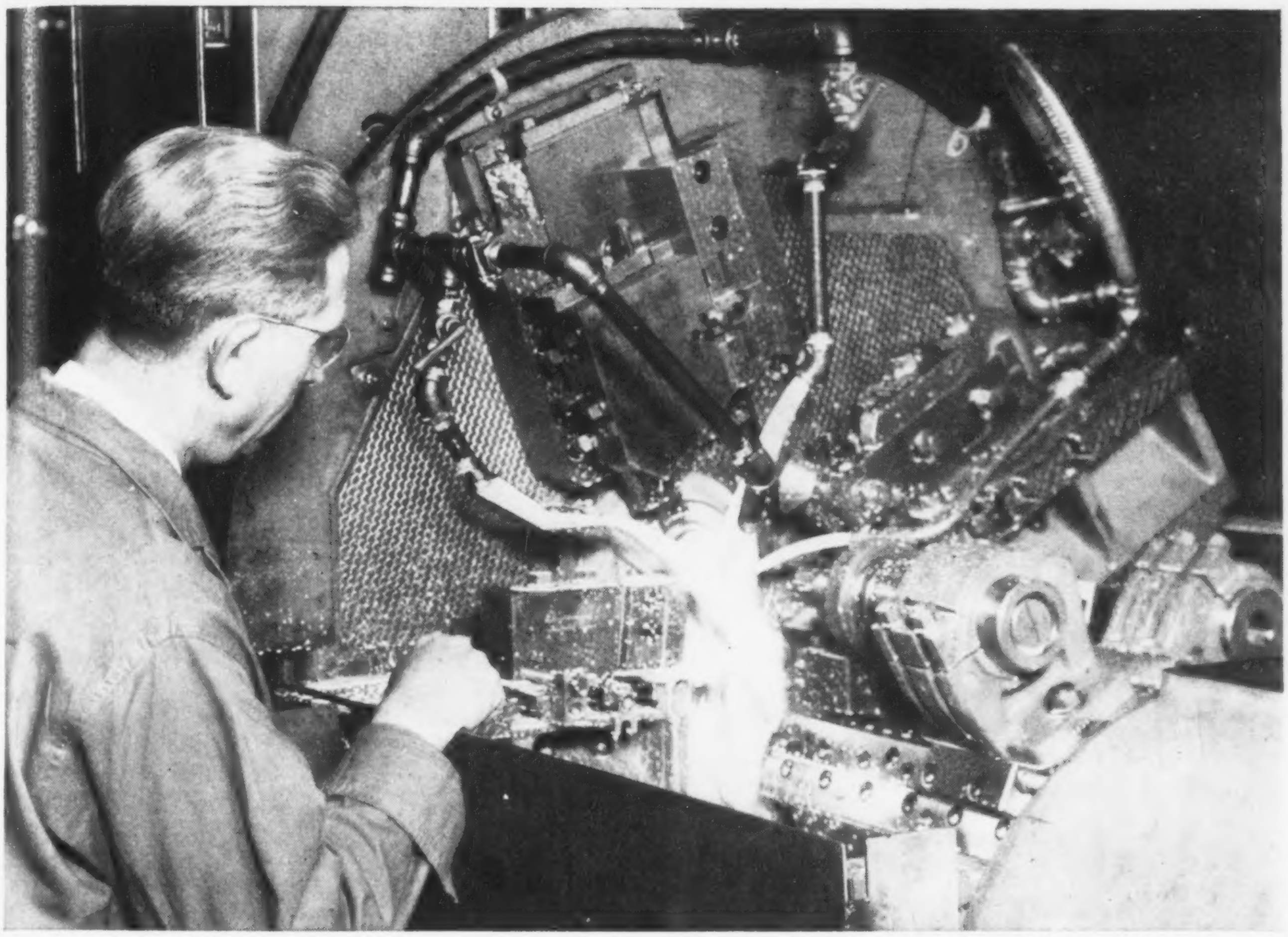
Room 1166, 327 South LaSalle Street **Chicago 4, Illinois**
Gentlemen:

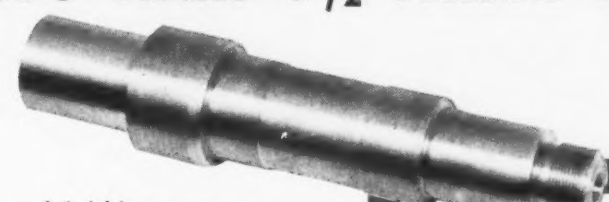
☐ *I want the A.B.C.'s about Wirebounds. Send a free copy of your booklet, "What to Expect from Wirebound Boxes and Crates."*

☐ *Please have a Wirebound sales engineer give me the facts as they apply to our product.*

Name ____ Position ____
Firm ____
Street and Number ____
City ____ Zone ____ State ____
Our Product is ____ It Weighs ____



MODEL M...more than $6\frac{1}{2}$ times faster on this shaft!



You can spot one of the important reasons for this production increase right in the design of the Acme-Gridley Model M Single Spindle Automatic. There are three automatic spindle-speed ranges to give the correct surface speed for any kind of cut, any diameter. On this job, for example, the operation sequence goes from carbide cuts, to high-speed steel for forming cuts, to die-head threading—and back to high-speed finishing cuts.

There are other time-saving features, too—independent camming for the eight tool slides, to permit combining cuts; wide, open tooling zones, for easy access; heavy, rigid frame construction, to permit the use of carbide tools; simple camming, for quick change-overs.

These and many others are explained in Bulletin M-50. Be sure to ask us for your copy.

JOB FACTS

PART........Steel Sprocket Shaft, $5\frac{3}{4}$" long

OPERATIONS................10

MACHINE TIME....1 Min., 50 Sec.

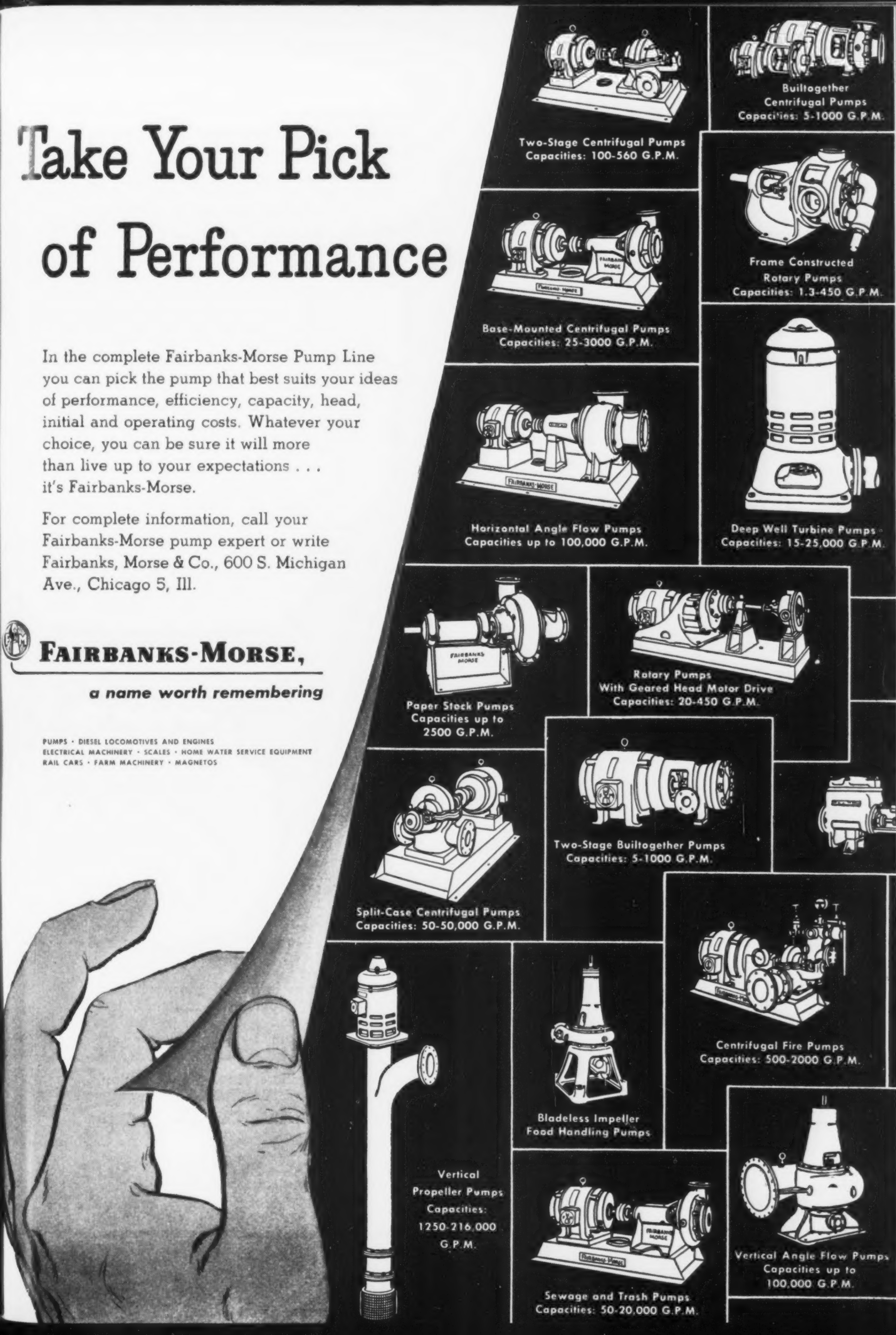
FORMER MACHINE TIME..12 Min. (Engine Lathe)

MACHINE.....$3\frac{1}{2}$" Acme-Gridley Model M Single Spindle Automatic.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing


Take Your Pick
of Performance
In the complete Fairbanks-Morse Pump Line you can pick the pump that best suits your ideas of performance, efficiency, capacity, head, initial and operating costs. Whatever your choice, you can be sure it will more than live up to your expectations . . . it's Fairbanks-Morse.
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Two-Stage Centrifugal Pumps
Capacities: 100-560 G.P.M.
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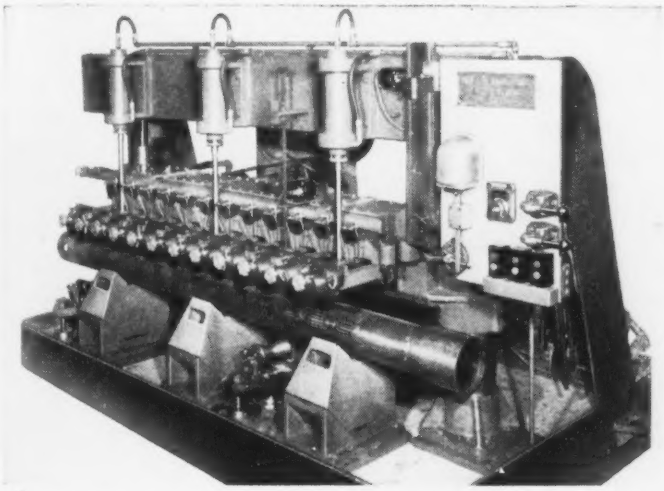
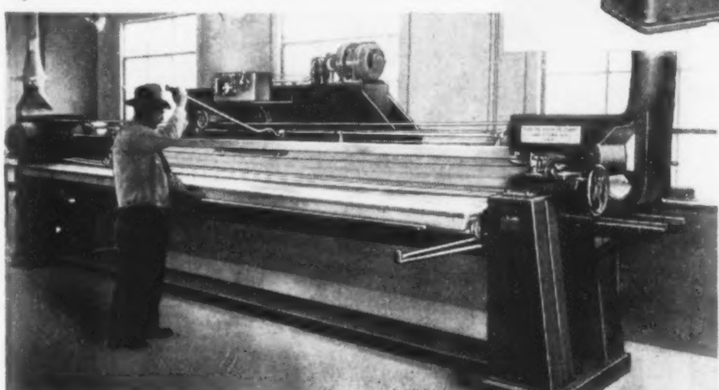
Capacities: 5-1000 G.P.M.
Base-Mounted Centrifugal Pumps
Capacities: 25-3000 G.P.M.
Frame Constructed
Rotary Pumps
Capacities: 1.3-450 G.P.M.
Horizontal Angle Flow Pumps
Capacities up to 100,000 G.P.M.
Deep Well Turbine Pumps
Capacities: 15-25,000 G.P.M.
Paper Stock Pumps
Capacities up to
2500 G.P.M.
Rotary Pumps
With Geared Head Motor Drive
Capacities: 20-450 G.P.M.
Split-Case Centrifugal Pumps
Capacities: 50-50,000 G.P.M.
Two-Stage Builtogether Pumps
Capacities: 5-1000 G.P.M.
Centrifugal Fire Pumps
Capacities: 500-2000 G.P.M.
Vertical
Propeller Pumps
Capacities:
1250-216,000
G.P.M.
Bladeless Impeller
Food Handling Pumps
Sewage and Trash Pumps
Capacities: 50-20,000 G.P.M.
Vertical Angle Flow Pumps
Capacities up to
100,000 G.P.M.

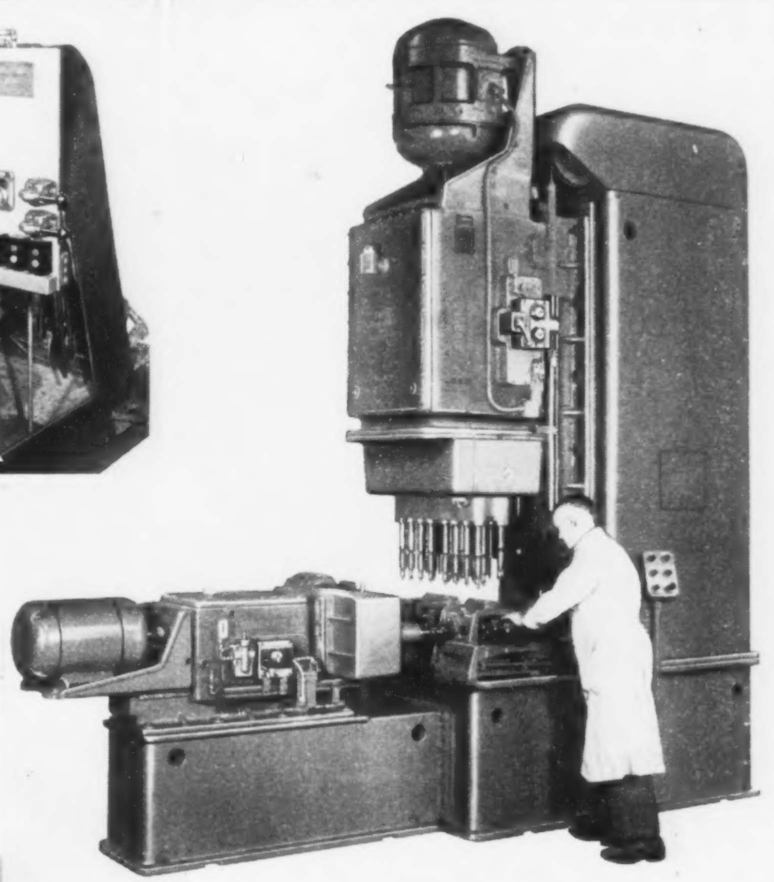
MORE COST-CUTTING APPLICATIONS OF VICKERS HYDRAULICS



Oil well casing slotting that formerly cost $1.25 per foot is now done at $0.90 per foot on the new machine designed and built by Allen Machine & Tool Co., Compton, California. Vickers hydraulic equipment raises and lowers the feed rail, controls feed rate and rapid traverse of cutters.

Hydraulic unit converted old belt sander to modern automatic stroke sander and reduced time for sanding pew backs from 15 minutes to 1½ minutes. Also improved quality. Built by Curtis Machine Corporation, Jamestown, N. Y. Vickers Hydraulics used exclusively.





This four-way, 38 spindle special purpose machine by Modern Tool Works, Ltd., Toronto, Ontario, does the drilling, spot facing and chamfering operations on an automobile engine head at the rate of one per minute. Vickers Hydraulic helps give it speed, control and precision.

Every day more and more machines are increasing production and cutting costs with the help of Vickers Hydraulics. See for yourself what Vickers Hydraulics can do for you . . . write for Catalog 5000 or call in a factory trained Vickers application engineer.

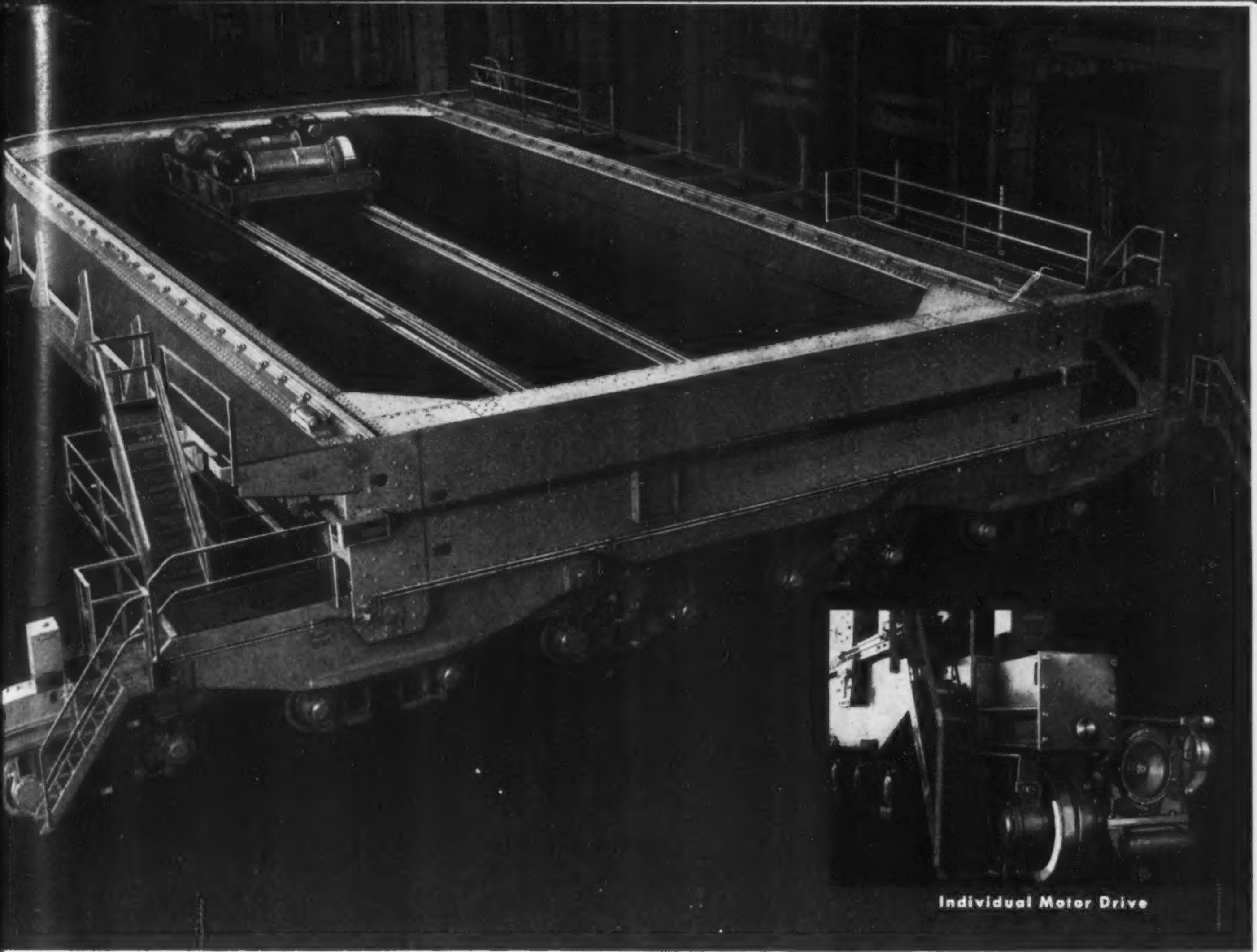
VICKERS Incorporated • 1420 OAKMAN BOULEVARD • DETROIT 32, MICHIGAN

DIVISION OF THE SPERRY CORPORATION

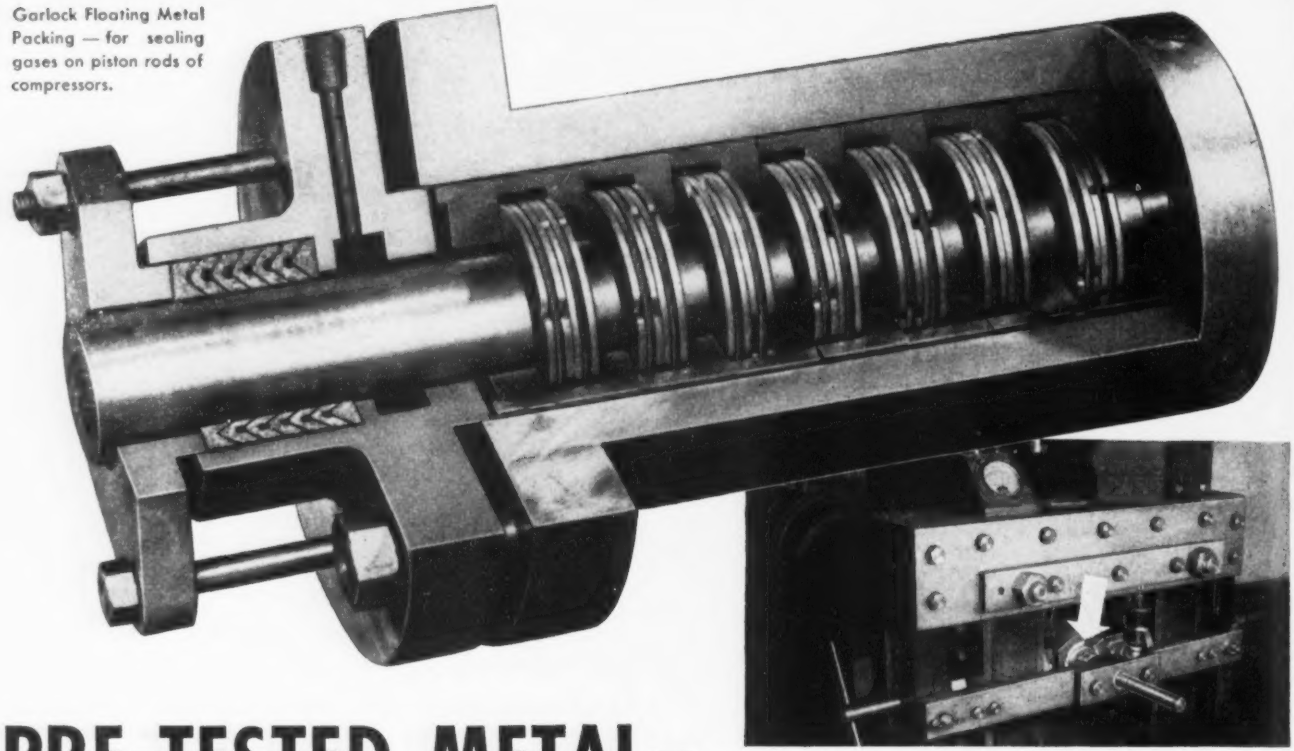
Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT HOUSTON • LOS ANGELES (Metropolitan) • NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) PITTSBURGH • ROCHESTER • ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

4763


Individual Motor Drive

Garlock Floating Metal Packing — for sealing gases on piston rods of compressors.



Above: Arrow points to foundry specimen being wear-tested on specially designed machine.

PRE-TESTED METAL—

Your assurance that Garlock Metal Packings are right for the job!

Designed specifically for high pressure and high temperature service to seal air, ammonia, steam or any gas on piston rods of compressors and steam engines, Garlock Metal Packings are quality-controlled throughout their entire manufacture.

Starting with the metals of construction, every "heat" of cast iron and bronze is accelerated-wear-tested on a special machine by an independent organization before the materials are shipped to Garlock. If the wear test specimen does not pass Garlock's rigid standards, then the entire "heat" is rejected.

Then, using these tested, high-grade materials, Garlock Metal Packings are accurately machined to exacting specifications by experienced craftsmen. Throughout every operation extreme precision is the watch-word.

The product of this rigid pre-testing and precision manufacture is a metal packing that you can be sure will meet your service requirements. So, standardize on Garlock Metal Packings—they last longer, require less maintenance.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

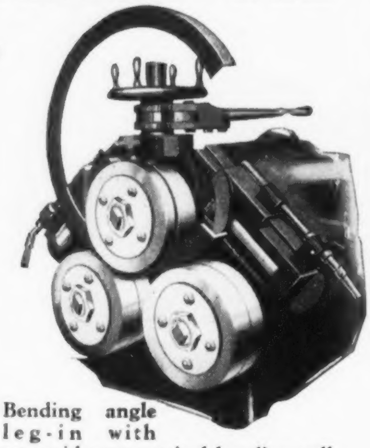
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK FLOATING METAL PACKINGS

"Buffalo" Tips on Metal Bending

GETTING THE FULLEST USE FROM THE BENDING ROLL—

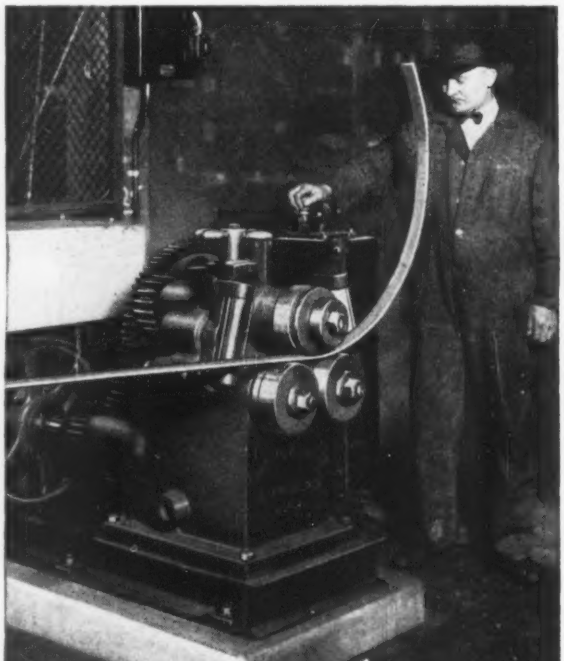
Channel bent to full circle leg-in — Tube bent in spiral — Arcs and circles



Bending angle leg-in with pyramid type vertical bending roll.

EASILY CHANGED ROLLS OPEN UNLIMITED POSSIBILITIES

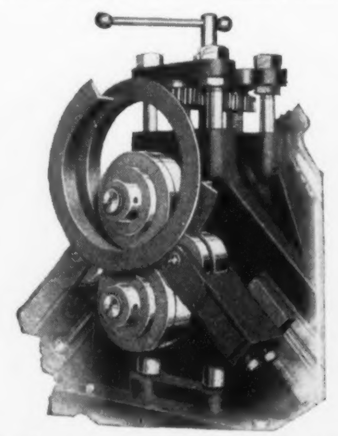
Those who own "Buffalo" Bending Rolls know that they are the fastest and cheapest method of producing arcs, spirals and circles accurately. Not so well known is the wide variety of jobs these machines will handle. Square stock is rolled in coils for ring gears by the automotive industry. Many lawn mower manufacturers bend and twist reel blades with their rolls at rates of around 300 an hour. Also, because rolls are so easily and quickly changed, it is practical to obtain special rolls and increase the versatility of the machine. Below are some examples:



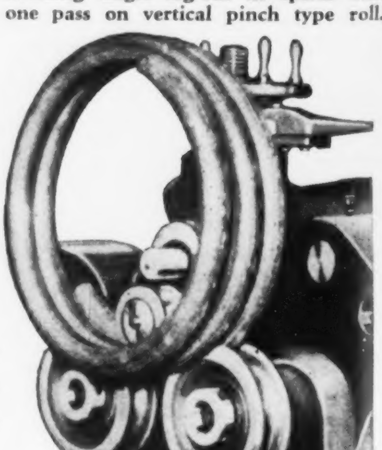
"Buffalo" No. ½ Vertical Bender rolling flats on flat. Very small diameters can be obtained at a single pass.

1. Angles, leg-out
2. Angles, leg-in
3. Beams on flanges
4. Channels, flanges in or out
5. Flats on edge
6. Flats on flat
7. Rounds
8. Squares
9. Copper tubes
10. Standard St. pipe
11. Heavy pipe
12. Heavy pipe

BULLETIN 352-C, with helpful information on bending, is yours on request.



Bending angle leg-out in spiral with one pass on vertical pinch type roll.



Bending tubing with small - diameter attachment and special rolls.

DIAMOND JUBILEE 75TH ANNIVERSARY

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

492 BROADWAY — BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING — PUNCHING — SHEARING — CUTTING — BENDING

PERFECT SURFACE IS A "MUST". . .

Large drying rolls, like the one below receiving its final polishing pass, are used in "Yankee Dryer" paper-making machines which turn out soft facial tissue. Even slight surface flaws in these eight- and twelve-foot diameter castings cause them to be rejected.

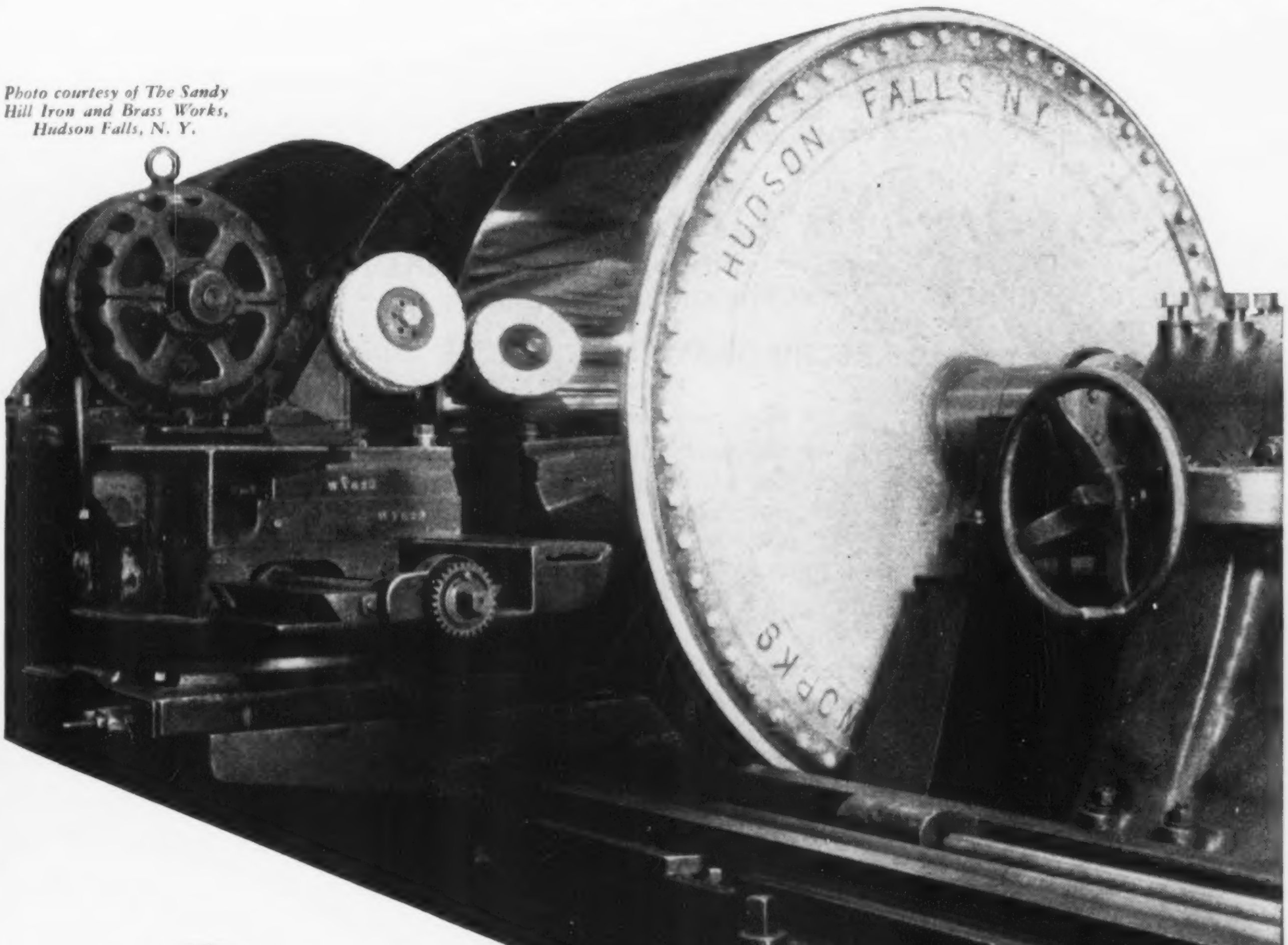
So they use CHATEAUGAY PIG IRON

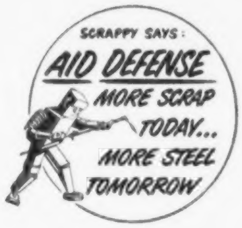
. . . the low-phosphorus, copper-free pig iron that has eliminated scrap losses in countless "tough casting" jobs. With CHATEAUGAY, consistently uniform "physicals" assure predetermined fine grain structure throughout every casting, regardless of size or shape.

Whatever the requirements of your castings—if ordinary pig iron won't do the job—NOW is the time to investigate the *exclusive* advantages of premium CHATEAUGAY. A Republic Pig Iron Metallurgist will be glad to give you the complete facts at your convenience. Write today to:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Photo courtesy of The Sandy Hill Iron and Brass Works, Hudson Falls, N. Y.





***Republic* PIG IRON**

"CHATEAUGAY" Low Phosphorus, Copper-Free

"REPUBLIC" (Northern) Foundry, Basic and Malleable

"PIONEER" (Southern) Foundry and Basic

REPUBLIC STEEL

BROWNHOIST

BUILDS BETTER BULK MATERIALS HANDLING EQUIPMENT

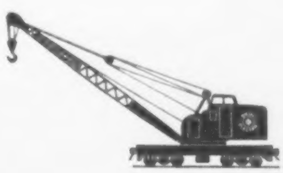
For over three quarters of a century Brownhoist has engineered, designed and built boat unloaders, storage bridges, cranes and car dumpers for efficient handling of coal, ore and other bulk materials in practically every corner of the world.

Railroads, steel mills and dock operators interested in machinery for handling ore, coal or other bulk materials will find that it pays to discuss their requirements with Brownhoist engineers.

Brownhoist equipment includes unloaders, fast plants, traveling bridge cranes, Diesel and Diesel Electric locomotive cranes, clamshell buckets, car dumpers, car pushers, shipyard cranes, and related machinery.

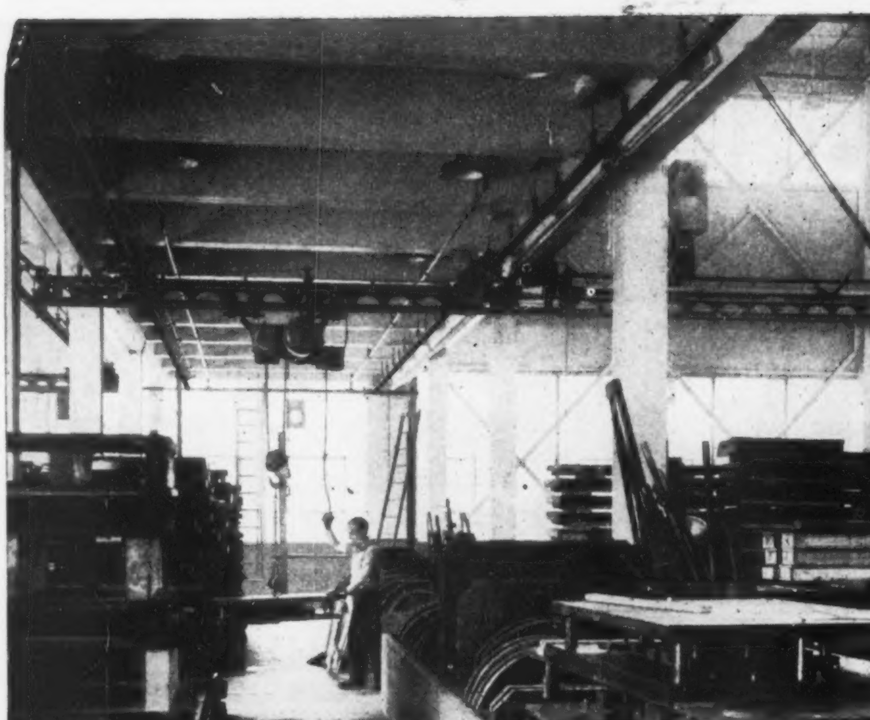
BROWNHOIST BUILDS BETTER CRANES

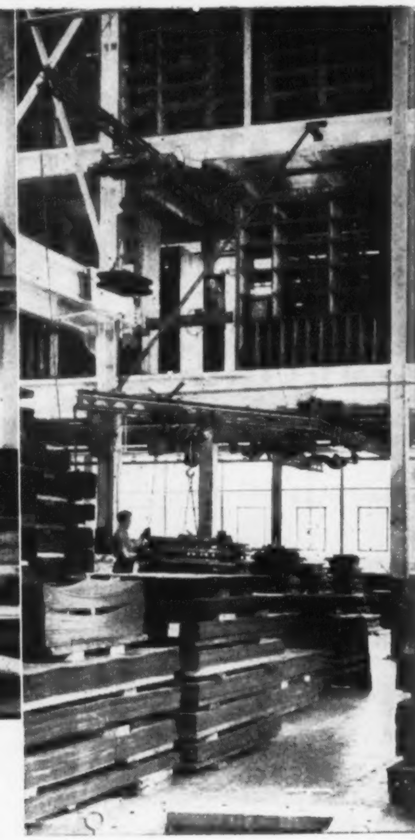
160

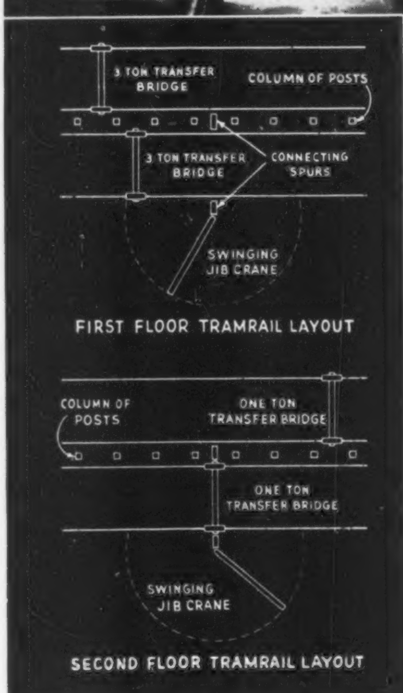


INDUSTRIAL BROWNHOIST CORPORATION
BAY CITY, MICHIGAN

DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago, Canadian Brownhoist, Ltd., Montreal, Quebec • **AGENCIES:** Detroit, Birmingham, Houston, Los Angeles







... Unique Tramrail Layout

... Solves Handling Problem

The problem of handling heavy dies in the plant of a large electric motor manufacturer was solved by a combination of standard Cleveland Tramrail transfer bridges and swinging jib cranes.

The dies are stored on the first floor at one end of the building and also on a mezzanine directly above. Two crane runways with interlocking transfer bridges and a jib crane are provided for the first floor and similar handling equipment for the mezzanine. The equipment for the first floor is of 3-tons capacity because the heaviest dies are stored there. Lighter dies are stored on the mezzanine and only one-ton equipment is required here.

The Cleveland Tramrail equipment makes it an easy job to deliver dies to and from any point on the first floor or the mezzanine. Since the areas covered by the swinging jib cranes overlap, loads may be easily transferred from first floor to mezzanine or vice versa.

The bridges and carriers are hand propelled since the effort required to propel them even when fully loaded is very little. The heavy lifting is done by push-button-operated electric hoists.

Cleveland Tramrail representatives are in a position to help you solve today's problems or develop plans for the future.

GET THIS BOOK!
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy

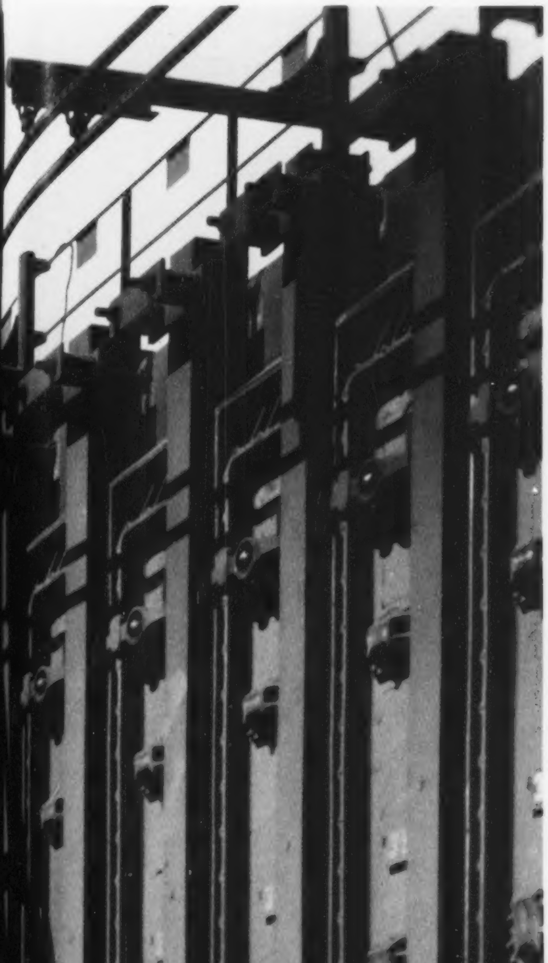
CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
4845 East 284th St. Wickliffe, Ohio

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

ABC's of

# of good coke-oven construction



● Typical Koppers-Becker Underjet Coke Ovens. Built in two batteries of 53 ovens each, these 106 ovens carbonize approximately 2,600 net tons of coal per day. They are underfired with coke-oven gas and are equipped with waste-gas recirculation.

A good basic design

The efficiency of any coke oven hinges entirely on its design. We believe that Koppers-Becker Coke Ovens have the best basic design. As a result, these ovens are sturdy, free from complications, simple to control. They also have the largest practical coking capacity.

This basic design meets diversified conditions. It can be employed when heating by any kind of fuel gas normally available, when building large or small ovens. This design results in low maintenance and in long life.

B constant engineering refinements

Koppers builds a great many coke-oven plants and is therefore in a position to anticipate new needs. For example, the waste-gas recirculation system was developed by us to meet the need for uniform heating when using rich fuel gas.

C skilled engineering staff

There is no substitute for a skilled engineering staff. Through the years, our engineers have proved their ability to design and erect the most advanced and efficient coal-carbonization equipment . . . material-handling systems . . . gas-treatment equipment.

Constructing coke ovens and related equipment is just one way in which Koppers serves the steel industry. For any kind of metallurgical construction, you can count on Koppers. You are invited to consult with our Engineers and Management.

KOPPERS

Engineering and Construction Division

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.

A man with a hate

● There's no halfway feeling about fire and its resulting destruction with an expert fire protection engineer ... he actually hates to see a little fire roar into a raging inferno and create a sizeable loss.

This personal sense of responsibility is inherent with C-O-TWO Fire Protection Engineers ... a definite plus in your behalf. Whether its fire detecting or fire extinguishing ... portables or built-in systems ... C-O-TWO means top quality backed by experienced engineering that results in operating superiority for you at all times.

With C-O-TWO Fire Protection Equipment, simplicity, practicability, longevity and minimum maintenance are built-in features that guarantee fast, positive action the instant fire strikes. Furthermore, extensive manufacturing and field installation skills, together with approvals such as the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus assure you of the finest in modern fire protection equipment.

Rushed production periods and future expansions are some of the many problems carefully considered in a plant-wide firesafety recommendation by C-O-TWO Fire Protection Engineers ... the prime objective always being the best type fire protection equipment for the particular fire hazard concerned.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today ... our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

C-O-TWO FIRE EQUIPMENT OF CANADA, LTD. • TORONTO 8 • ONTARIO

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

There's plenty of reserve capacity, more than enough for all your needs. And take a look at the acid and alkali resistant coating on these oversize transformers and selenium stacks—that's real assurance of dependable long life. But that isn't all. Those connections from the transformers to the selenium rectifiers are so flexible that floor vibrations can't possibly loosen the cell connectors. And for ventilating, the chimney effect produced by drawing clean cool air through the cabinet cuts the danger of overheating. These advantages are built into every H-VW-M rectifier—the ones you see in these crates ready to be shipped—and those in service all over the country. They're built to last for *years.*

Durable, dependable rectifiers are only one of the many results of H-VW-M's constant progress in electroplating development for more than eighty years. It's a continuous policy, best summed up in H-VW-M Platemanship . . . your working guarantee of the best that industry has to offer—not only in rectifiers—but in every phase of plating and polishing.

8529

this oversize rectifier transformer is typical of H·VW·M "extras"

PLATEMANSHIP

PLATEMANSHIP · PLATING & POLISHING · PROCESSES · EQUIPMENT · SUPPLIES

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

HANSON-VAN WINKLE-MUNNING CO., MATAWAN, N. J.
PLANTS AT MATAWAN, N. J. • ANDERSON, INDIANA
SALES OFFICES ANDERSON • BOSTON • CHICAGO • CLEVELAND
DAYTON • DETROIT • GRAND RAPIDS • MATAWAN • MILWAUKEE
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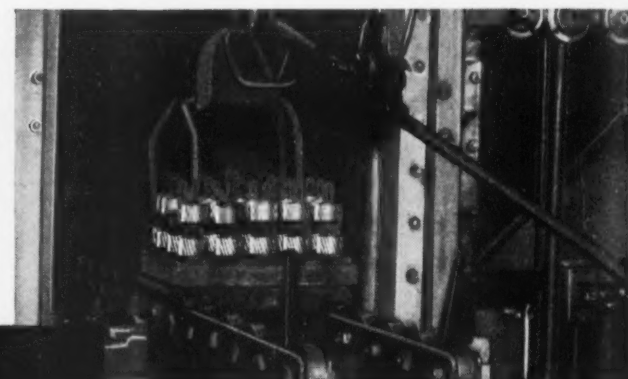
Hanson-Van Winkle-Munning Co. · Matawan, New Jersey, U.S.A.

H·VW·M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Versatility of GAS in Industry



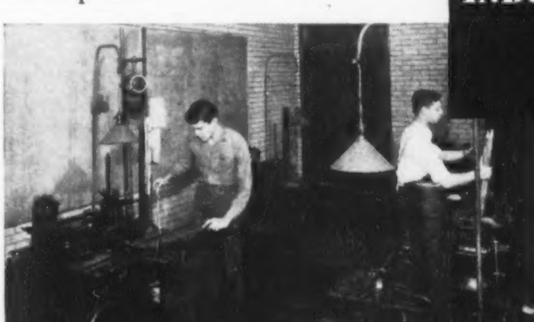
GAS... THE MODERN FUEL FOR ALL INDUSTRY

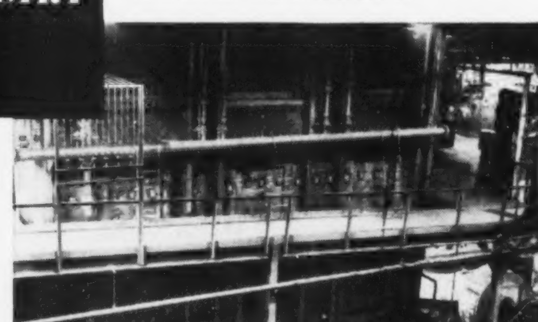
ELECTRONICS—Glass face of television tube is bonded to metal cone with automatic GAS equipment, assuring strong, vacuum-tight glass-to-metal bond, for large manufacturer of electronic equipment.

GRAPHIC ARTS—Monotype casters with Gas-fired metal pots, Linotype machines, smelters, ink dryers, stereo casters, etc. utilize the economical, versatile flames of Gas for printing in modern plants.

METALS—Gas meets rigid heat-processing requirements of production-line heat treatment, as in the case hardening of gears, for an automobile manufacturer, because Gas affords precise, automatic temperature control.

GLASS—Modern Industrial Gas Equipment is found throughout the glass industry—an example of which is this 100-ton continuous batch Gas-fired melting tank for making glass for a large industrial manufacturer.





Whatever your industrial production problems, however tight your schedules, Gas and Modern Industrial Gas Equipment can provide the answers. For the facts on GAS, call your Gas Company Representative, today.

AMERICAN GAS ASSOCIATION • 420 LEXINGTON AVE., NEW YORK 17, N.Y.

The New Day's Dawning!

Plant Expansion   Plant Modernization

A Progress Report on Monarch's Improved Lathe Production

Your Monarch lathe order may be closer to delivery than you think! Very soon, now, our expansion program will be completed—and every day output increases as we move new tools and production lines into each unit on the heels of construction crews.

Monarch output for '52 will be about double that of '51, and the architect's rendering above largely explains this growth. Upon completion of our program, we will have added a whopping 43% to our floor space since the close of World War II, and completely modernized the 25% requiring it. Tool and equipment additions, of course, are in proportion. With a completely modernized plant plus this great an increase in floor space, you can see why we're confident of cutting into our backlog fast.

Every day, we're better able to handle new orders and to move faster on present orders—and there'll be continuous improvement with each day's operation. So hang on to your precious priority order. Let us have your new orders. Your new Monarchs are getting a lot closer than they were. . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

Monarch

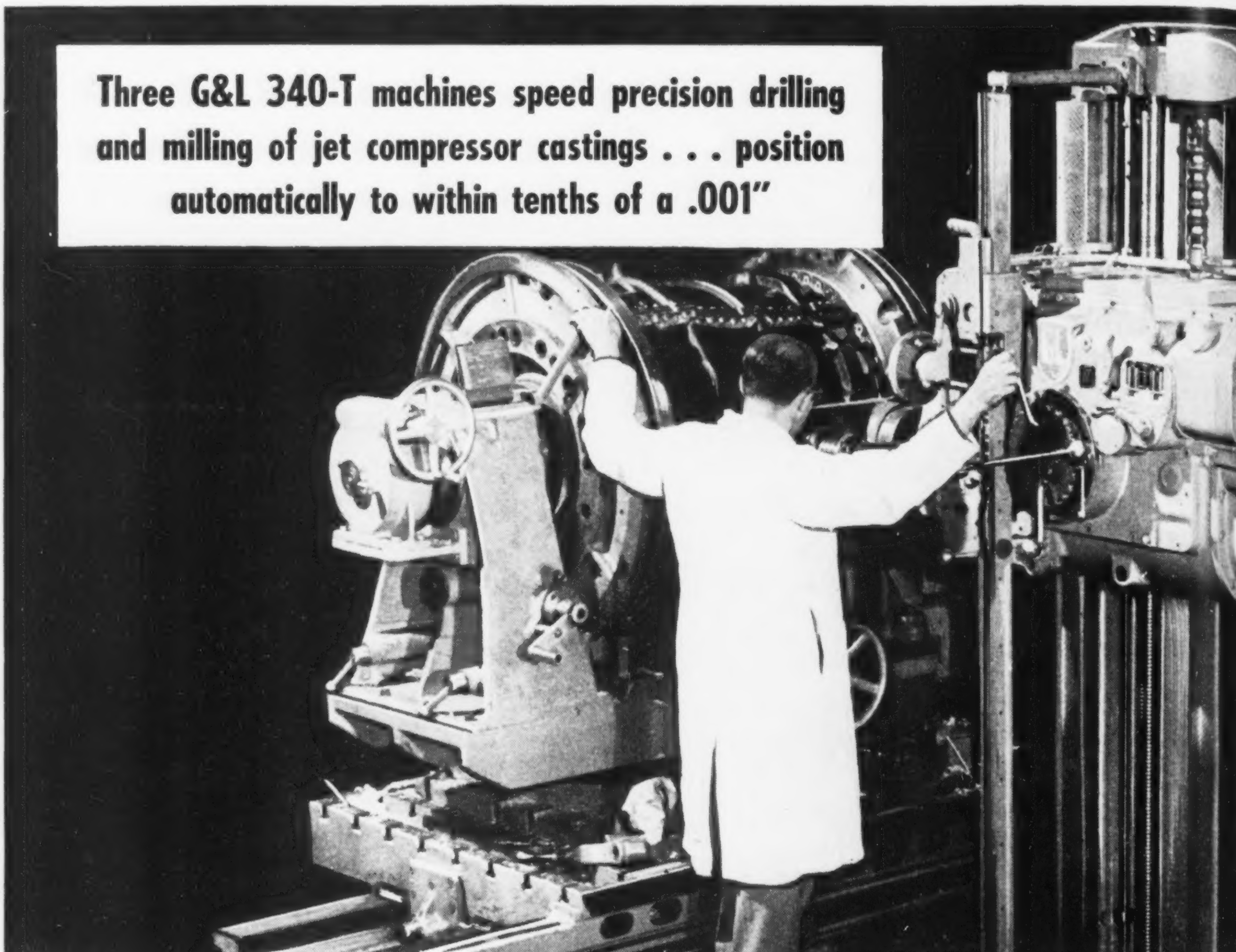
ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

This high-priority job demands ex

Three G&L 340-T machines speed precision drilling and milling of jet compressor castings . . . position automatically to within tenths of a .001"

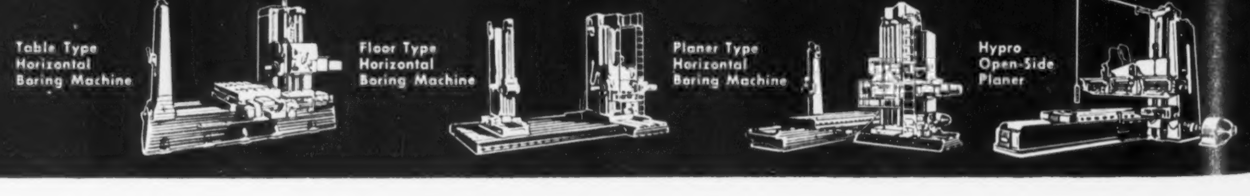


THOUGH complete production data must be withheld for security reasons, A. V. Roe Canada, Ltd., reports three G&L Horizontal Boring, Drilling and Milling machines are making an important contribution toward increased production of the Orenda jet engine.

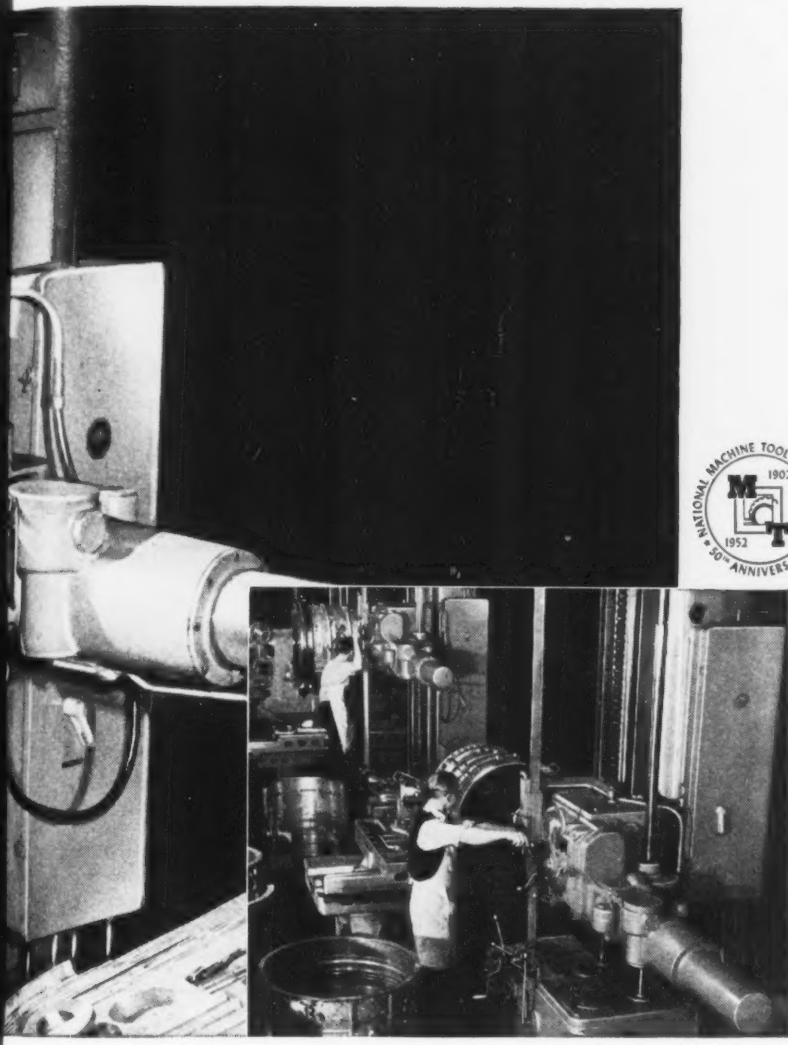
These machines are equipped with the G&L automatic electric positioning device. This outstanding feature allows fast positioning of the casting accurate to within tenths of .001".

Like A. V. Roe, you too will find that for your work . . . big or small . . . simple or complex . . . you'll save time and money with the G&L line. Maybe you'll want a G&L Horizontal Boring, Drilling and Milling machine—or a G&L Hypro Planer, Planer-Miller or Vertical Boring Mill. But what-

GIDDINGS & LEWIS



ls extra-close tolerances



Photos show G&L 340-T's working on jet compressor castings. Note small revolving table mounted on standard table which speeds positioning.

ever your need, you can be sure that G&L's unbiased Job Analysis Service will give you an answer that will mean savings. See our nearest representative or write direct. Get the facts about G&L Job Analysis today. There's no obligation . . . and DELIVERY ON G&L MACHINES MIGHT BE BETTER THAN YOU THINK!

G&L 5-POINT JOB ANALYSIS

takes the guesswork out of machine tool buying . . works for you and with you to solve big or complex machining problems..increases production . . reduces machining costs

1 **COMPLETE STUDY OF YOUR JOB OR JOBS** — G&L Job Analysis Engineers, working with your engineers, analyze your requirements by: (1) number and size of parts to be produced (2) number and kind of operations needed, (3) tolerances and finishes required.

2 **DETERMINE MOST EFFICIENT MACHINING METHOD** — Taking into consideration the individual machining requirements of the job, G&L Job Analysis Engineers choose the most efficient machining method. G&L engineers can give an unbiased opinion because G&L builds a complete line of sizes and types of planers, planer-millers, vertical boring and turning mills and horizontal boring, drilling and milling machines . . . plus a complete line of accessories and tooling for these machines.

3 **SELECT THE SIZE, KIND AND TYPE OF MACHINE**—The machining method now determined, G&L Job Analysis Engineers — using your production and work requirements — recommend the exact size, kind and type of machine that will do the job most efficiently.

4 **PLAN YOUR OPERATIONS** — After the selection of the most efficient machine to fit your needs, G&L Job Analysis Engineers plan a sequence of operations that will (1) minimize number of setups and setup time, (2) use modern cutting tools to best advantage, (3) take full advantage of the machine working ranges and capacities, (4) keep operator fatigue to a minimum.

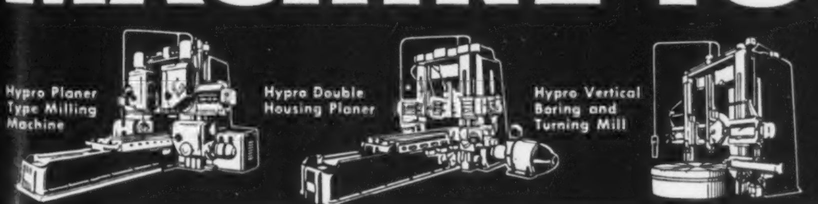
5 **RECOMMEND (AND DESIGN IF NECESSARY) THE TOOLS TO USE** — If conditions warrant, G&L will recommend the standard machine accessories, arrangements and tools you can use to make your equipment more productive—more versatile in application. If special equipment is needed, it will be designed to agreed specifications and made a part of your order.

Write, wire or phone G&L or its nearest representative today. Get the facts on your needs — your problems. Get a G&L unbiased Job Analysis to help you. Don't hesitate — there's no obligation . . . AND DELIVERY MAY BE BETTER THAN YOU THINK!

How to get a G&L job analysis

Call your nearest G&L dealer or write us direct. Furnish our Job Analysis Engineers with blueprints, job data, and production requirements. Factory engineers will completely analyze your machining problems. There's no charge, no obligation. Don't hesitate — do it today.

S MACHINE TOOL CO.

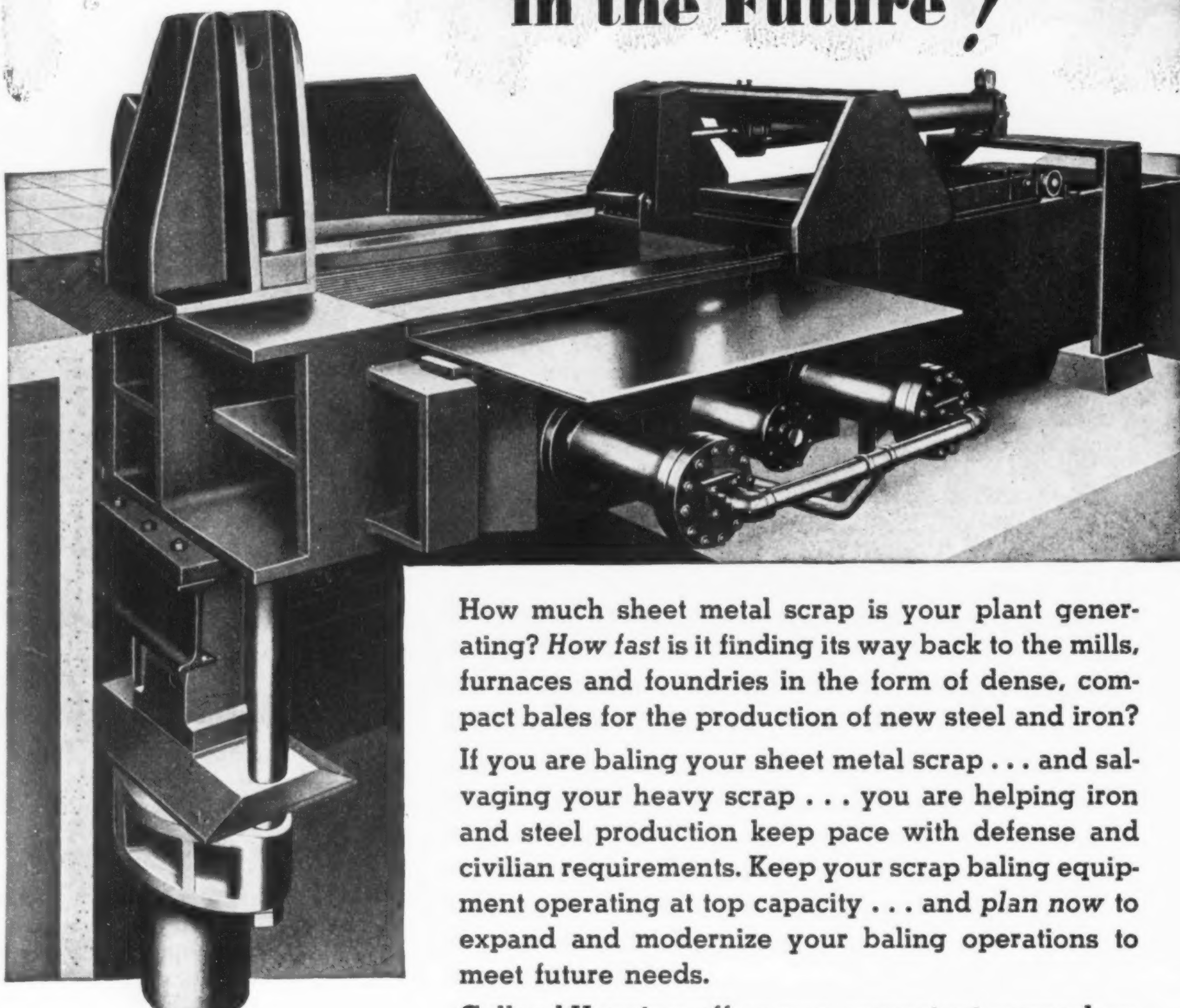


HYPRO

FOND DU LAC WISCONSIN

More BALED Scrap

Means More Iron and Steel for You...NOW and in the Future!



How much sheet metal scrap is your plant generating? *How fast* is it finding its way back to the mills, furnaces and foundries in the form of dense, compact bales for the production of new steel and iron?

If you are baling your sheet metal scrap . . . and salvaging your heavy scrap . . . you are helping iron and steel production keep pace with defense and civilian requirements. Keep your scrap baling equipment operating at top capacity . . . and *plan now* to expand and modernize your baling operations to meet future needs.

Galland-Henning offers you competent counsel on your baling problems, based on years of experience in the design, construction and installation of powerful, hydraulic scrap metal balers for steel mills, industrial plants and scrap yards.

GALLAND-HENNING MANUFACTURING CO.
2747 S. 31st ST., MILWAUKEE 46, WIS.

GALLAND-HENNING

SCRAP METAL BALING PRESSES

a BIRD

in the HAND . . .

● ● ● **A TUBE OF KNOWN QUALITY** is the all-important factor in reaching top production peaks. Penn tubing has held the title of 'constant quality' for over a quarter of a century. Carefully inspected to detect any flaws or impurities which might hinder production or cause rejections, Penn tubing nets greater output and gains a point for your side.

You can depend on Penn for *first* quality—for installations that are right the *first* time. Take advantage of Penn's knowledge and experience in helping you choose the right type of tubing for your needs.

Write for new specification literature and send along your tubing problems—Penn is always ready to serve. You need *first quality tubing* to make production soar—you need PENN.

ADDRESS CORRESPONDENCE
TO "DEPT. IA-10"

QUALITY TUBING HAS A *"PENN NAME"*

Penn

PENN BRASS & COPPER COMPANY

ERIE • PENNSYLVANIA • TELEPHONE 3-1164

Lodge & Shipley 60" T* lathes

in 6 distinctive models

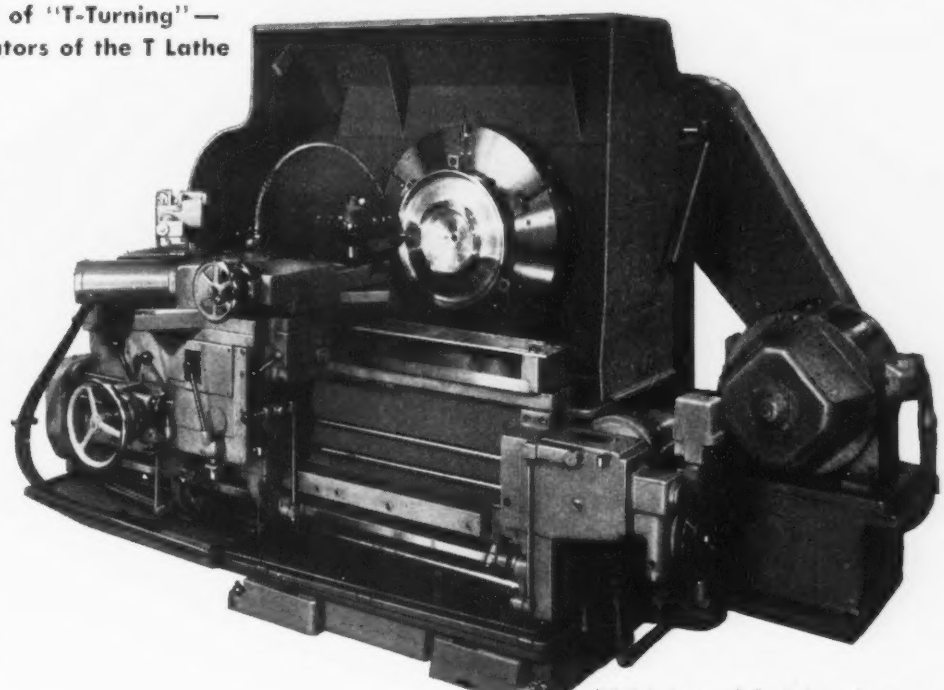
Further advances in the art of "T-Turning"— brought to you by the originators of the T Lathe

Developed as a result of the experiences and needs of jet engine manufacturers and others, these latest type Lodge & Shipley **T** Lathes offer even greater speed, accuracy and ease of machining.

These lathes have one or two carriages, either or both of which may be COPYMATIC controlled for automatic contour turning, facing and boring of short, thin-walled section work of large diameter. The new carriage arrangements further advance the art of *"T-Turning."*

Basically, the **T** Lathe costs less than conventional machines, saves 50% or more in floor space, obsoletes the use of large cumbersome engine and raised lathes for this type of work.

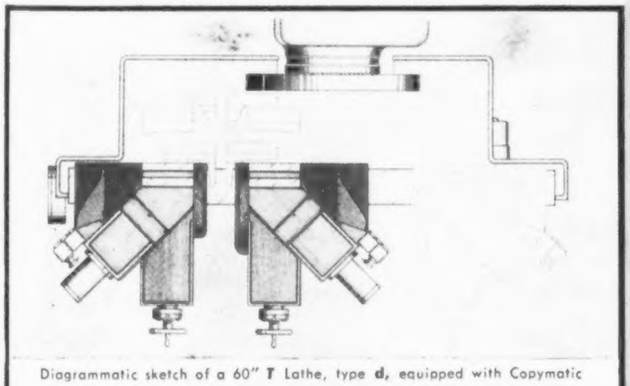
*Write for complete information and new **T** Lathe literature.*



60" **T** Lathe type **b-1**, single carriage: COPYMATIC "Cross-Center" Facing Carriage.

Choose a Lodge & Shipley T Lathe designed for short, thin wall large diameter work

Type a-1	for straight and angular facing, turning, boring
Type b-1	for contour facing on both sides of center . . . limited contour turning and boring
Type d	for contour turning, boring; straight facing and limited contour facing
Type e	for contour turning; straight and angular facing, turning, boring
Type i	for straight and angular facing, turning, boring
Type n	for straight and angular facing, turning, boring and contour boring



Diagrammatic sketch of a 60" **T** Lathe, type **d**, equipped with Copymatic Tracer Control for turning and boring with dual carriages.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3061 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

*T. M. The Lodge & Shipley Co.

Trouble SAVING!

with 854 sizes of . . . ready made bearings for machine tools and industrial machinery.

with 324 sizes of . . . completely finished bearings for electric motors of all sizes and makes.

with 263 sizes of . . . tubular and solid Bronze Bars completely machined on all surfaces.

Bunting Ads win 1st award in contest sponsored by Industrial Distributors Associations.

Bunting Standard Stock Bearings, Electric Motor Bearings and Precision Bronze Bars offer the quickest, simplest and most economical solution to your bearing problems in production and maintenance.

Bunting®

BRONZE BEARINGS • PRECISION BRONZE BARS • BUSHINGS

. . . IN STOCK EVERYWHERE

Bunting products are instantly available in all markets, from the stocks of leading industrial distributors and distributors of specialized industrial items. Ask your distributor or write for catalog.

THE BUNTING BRASS & BRONZE COMPANY • TOLEDO 1, OHIO • BRANCHES IN PRINCIPAL CITIES

NAZEL ELECTRO-PNEUMATIC FORGING HAMMERS

"Packaged"...

... BECAUSE THEY'RE ENTIRELY SELF-CONTAINED

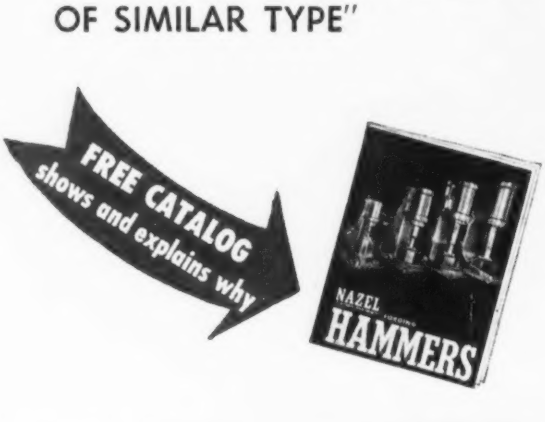
Hammer, Air Compressor and Electric Motor are "all one"—therefore, the NAZEL requires no boilers, compressors, tanks, piping, fuel, ash handling, shafting, pulleys, hangers, etc.

The NAZEL Hammer can be started or stopped at the mere push of a button, and it uses power *only when working* (think what this means in comparison with other types of hammers).

Low upkeep cost and *high efficiency* are outstanding features of the NAZEL.

To meet Industry's varied Forging Requirements ... we produce the NAZEL Hammer in 5 different types and 16 sizes.

"MORE USED THAN ANY OTHER HAMMER OF SIMILAR TYPE"

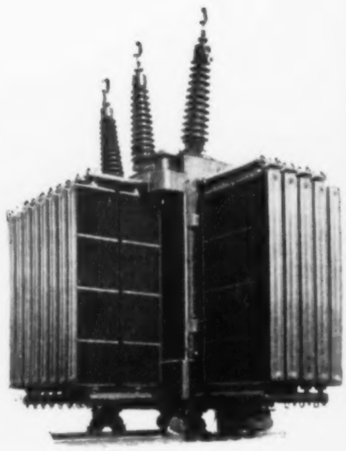


1836	**LOBDELL UNITED COMPANY** WILMINGTON 99, DELAWARE A SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY	1952

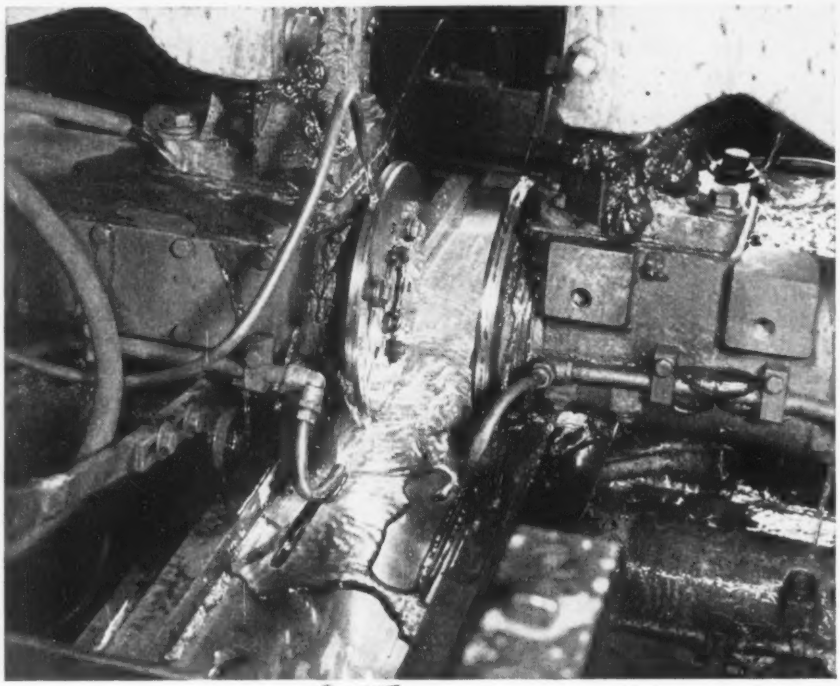
Look at this example of lowered production costs

with MALLORY 22

Seam Welding Wheels



Typical Westinghouse power transformer showing Mallory 22 seam welded radiators in place.



To fabricate steel radiators like those shown at right above, Westinghouse uses Mallory 22 seam welding wheels on this continuous resistance welding machine which welds two, mated, flat steel sheets.

LOOK TO MALLORY FOR ALL YOUR RESISTANCE WELDING NEEDS

For 25 years Mallory has pioneered a wide range of developments in the resistance welding field—including many widely used alloys and a wide range of electrodes and holders. They offer top performance at low cost. Call on Mallory whenever you need copper base electrodes, holders, dies, castings, forgings, rods and bars for resistance welding applications.

In addition to a complete line of resistance welding products, Mallory offers unexcelled engineering service.

Production costs dropped for Westinghouse when Mallory 22 seam welding wheels were put to work welding radiators for power transformers. Westinghouse finds Mallory 22 wheels last longer . . . require fewer dressings . . . cut set-up time . . . thus help speed production and lower costs.

Mallory 22 metal, a copper base alloy containing cadmium and zirconium, offers high strength, high conductivity, and high ductility at elevated temperatures. These characteristics give it great resistance to mushrooming and cracking—thus making it the ideal wheel material for mash seam welding or similar applications where the welding heat is high and where cooling of the wheel may be necessarily inefficient.

Whatever your needs for seam welding wheels may be, it will pay you to put Mallory's facilities and experience to work for you. Call or write Mallory today, or get in touch with your local Mallory distributor.

In Canada, made and sold by Johnson Matthey and Mallory, Ltd.
110 Industry St., Toronto 15, Ontario

P.R. MALLORY & CO. Inc.
MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:

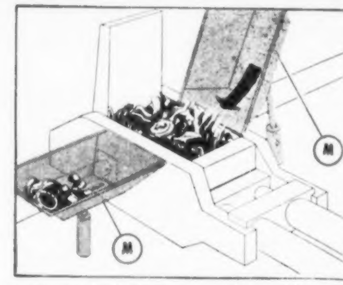
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Dry Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO., INC., INDIANAPOLIS 6, INDIANA

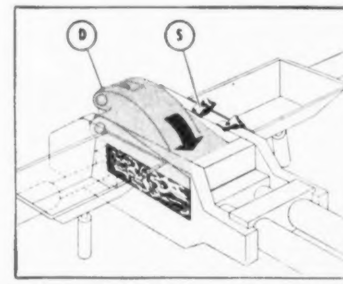
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio.

For high-density scrap bales up to 60 an hour

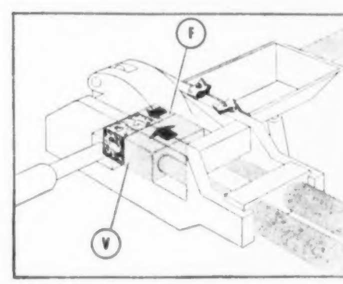
Use Lindemann heavy-duty "SI" Presses



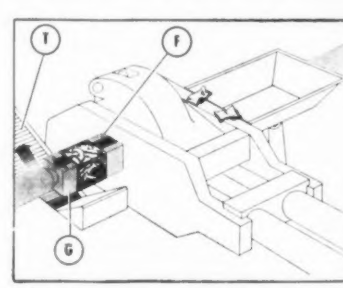
1. Scrap is fed by crane into either one or two hydraulically operated hoppers (M). Tilting motion of hoppers feeds scrap into press box.



2. Hydraulically-driven lid (D) enters press-box frame to exert first compression. Overhanging scrap (S) is cut off between edges of lid and serrated top of press box. Hoppers return to original position for refilling with scrap.



3. Half-pressure ram (V) closes to exert second compression. Final-pressure ram (F) closes for third compression that forms finished bale.



4. Final-pressure ram (F) and counter-pressure ram (G) eject bale directly onto conveyor belt (T), slide or elevator. Since hoppers have already been filled with scrap, machine is immediately ready for next pressing operation.

Keep scrap moving *quickly, economically* with Lindemann Baling Presses

Shearing effect of hinged lid increases capacity ...allows handling wide variety of scrap

If you're pressing bales weighing from 200 to 600 pounds...

You can handle bulky scrap—and compress it into high-density bales at rates up to one a minute—with Lindemann triple-action "SI" Presses.

Hoppers hold large quantities of scrap at a filling. Hydraulically powered hinged lid shears off overhang against patented serrated bars on box edges. Extra-high pressures are provided for pressing heavy materials into dense bales.

Patented bale ejection onto conveyor belt or elevator—no jamming of bales. Ruggedly built for rough usage in the yard. Adaptable to the needs of blast furnaces, electric furnaces, motor car body works, large metalworking plants and large scrap dealers' yards.

Press box sizes from 60" x 36" x 33½" to 100" x 60" x 39½".

LOOK INTO THESE OTHER LINDEMANN PRESSES, TOO!

Other Lid-Type presses handle bales as small as 100 pounds—or as large as 8,800 pounds.

Patented Shearing Ram Presses combine functions of scrap shear and baling press—do away with preliminary shearing or oxygen cutting.

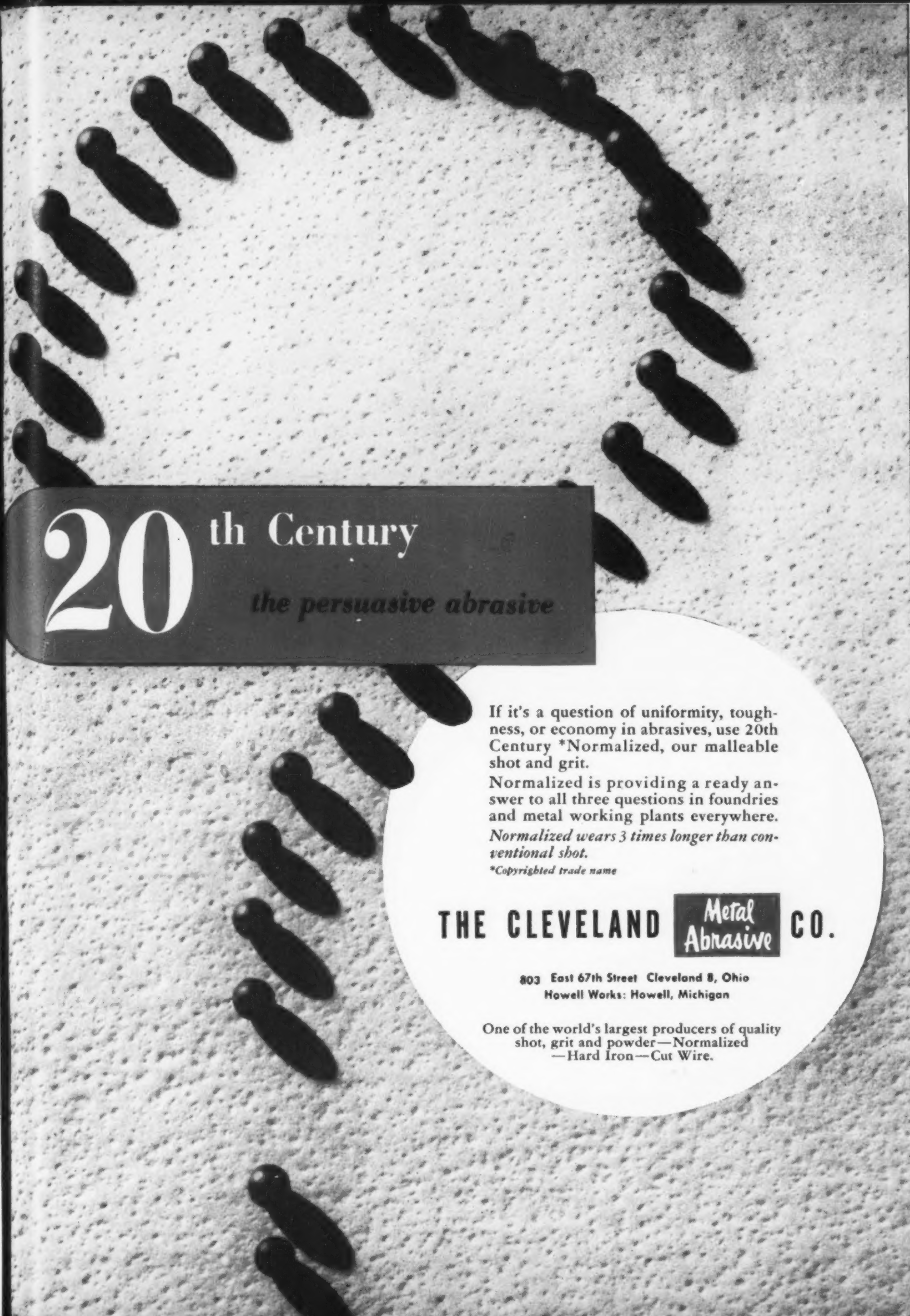
Just tell us the business you're in—and amount and type of scrap you handle. We'll send you literature on Lindemann Presses that meet your needs.

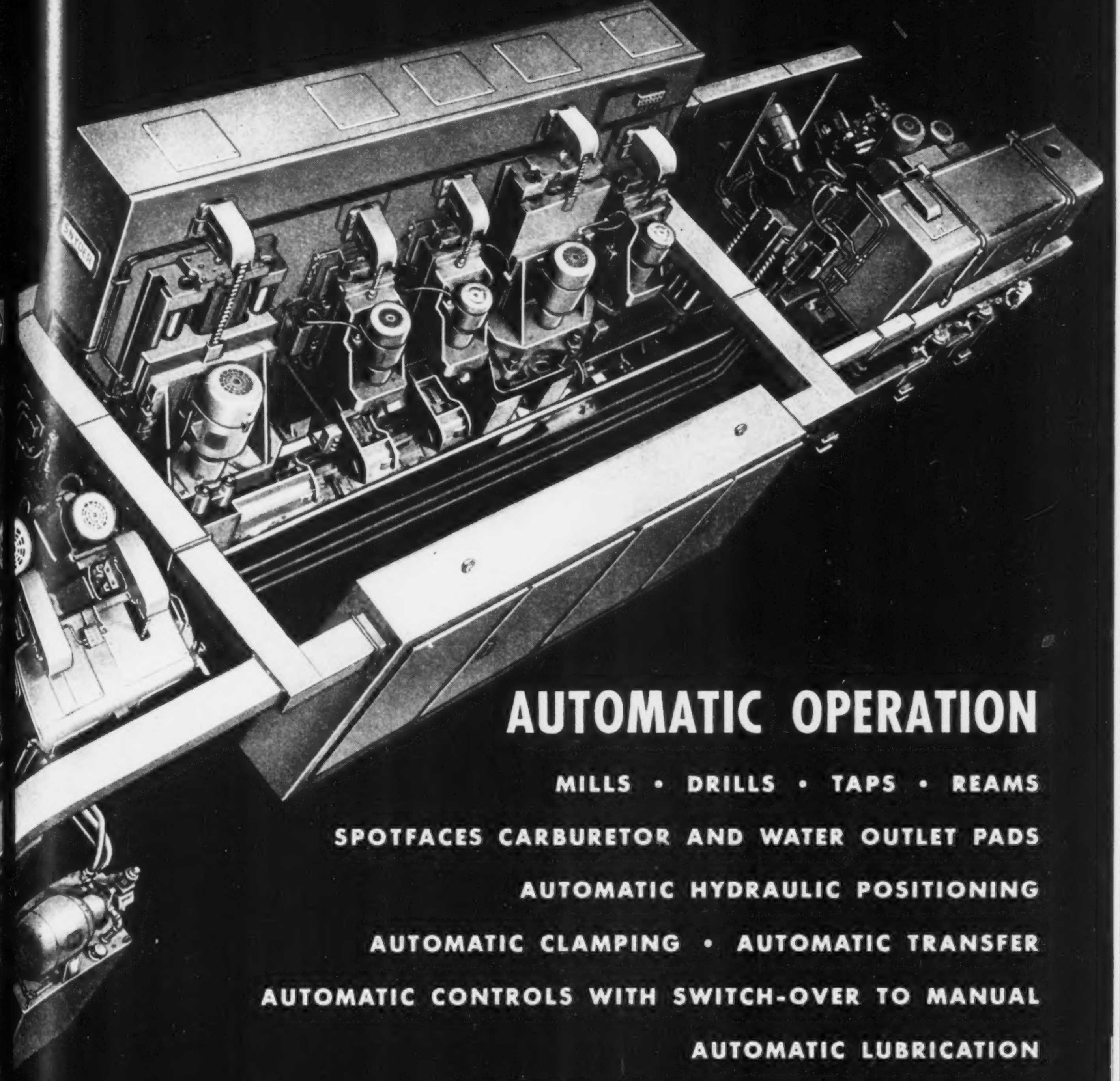
Replacement parts will be available at our Cleveland Service Center

KO CO., INC
INDUSTRIAL IMPORTERS

KURT ORBAN
COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit 35


20th Century
the persuasive abrasive
If it's a question of uniformity, toughness, or economy in abrasives, use 20th Century *Normalized, our malleable shot and grit.
Normalized is providing a ready answer to all three questions in foundries and metal working plants everywhere.
Normalized wears 3 times longer than conventional shot.
*Copyrighted trade name
THE CLEVELAND Metal Abrasive CO.
803 East 67th Street Cleveland 8, Ohio
Howell Works: Howell, Michigan
One of the world's largest producers of quality shot, grit and powder—Normalized—Hard Iron—Cut Wire.

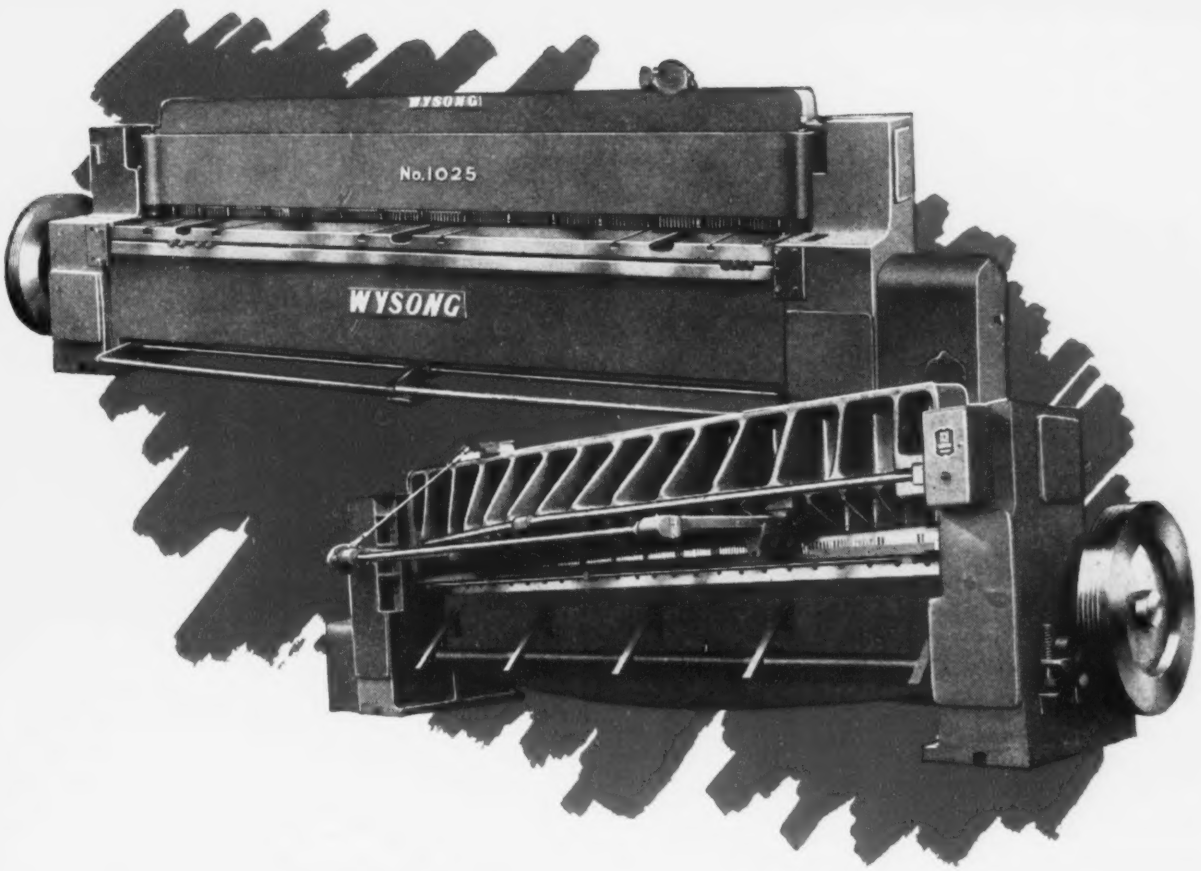


Roll your own tubing from strip

In one continuous, automatic operation, the AEF Tube Mill converts steel strip into the finest welded tubing. Each mill is a compact, high-speed unit that will produce the highest grade tubing with a minimum of labor, over-head, and capital investment. Over 30 years of successful performance demonstrate that the economy of operation—at 1/8 of one cent per each foot length of tubing—permits the return of the original investment in intervals ranging from 28 days to 6 months. It is impossible to purchase your pipe and tubing requirements to compete with rolling your own on an AEF Tube Mill. Our engineers will plan your installation and give your operators training in operation and procedures. Write us giving the sizes and quantities of tubing needed and the uses for which it is intended. Tubing is guaranteed to be plus or minus .003″ in diameter and concentricity. AEF Tube Mills are manufactured in three sizes, to produce pipe and tubing with wall thicknesses of .025″ to .157″ and outside diameters from 1/2″ to 4 1/2″ O.D.

AMERICAN ELECTRIC FUSION CORPORATION

CHICAGO 47, ILLINOIS, U. S. A.



WYSONG $\frac{1}{4}$ INCH PLATE SHEARS

No matter how you look at it you can see the massive, rigid construction of the WYSONG ¼-inch series . . . made in 4, 6, 8, and 10 feet cutting lengths. Bed, end frames, and knife bar are one-piece Hi-tensile castings. Bearing surfaces between end frames and table, and gibbed ways for hold-down and knife bar travel are hand scraped for perfect fit and true squaring.

A clearly visible cutting line makes it easy to cut to a scribed line. Slotted metal finger guard, mounted on hold-down, protects fingers without obstructing view.

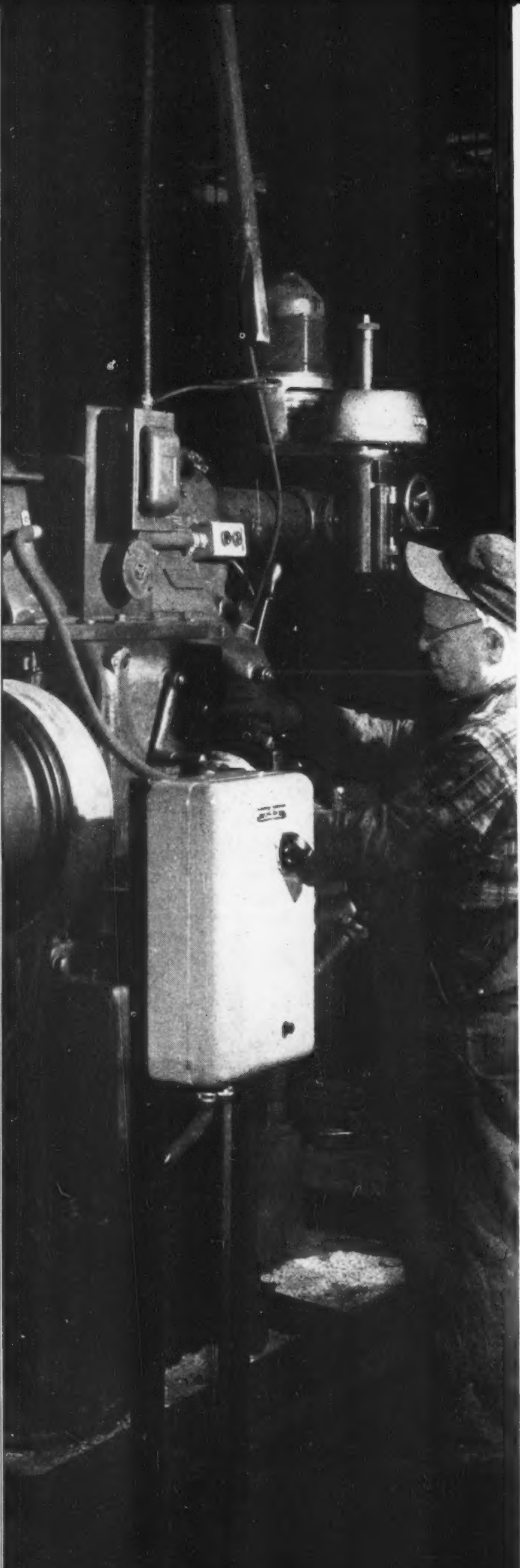
An automatic, mechanically operated *hold-down* provides powerful, positive hold down action. The simplicity of the roller and cam action makes it sure and trouble free. Individual compression springs in each foot compensate for varying thicknesses in metal being sheared . . . Front operated, ball-bearing *back gauge,* adjustable to .0078 (1/128th) of an inch, is standard equipment. A *power operated back gauge,* in ranges of 24 and 36 inches can be furnished at extra cost . . . Powerful WYSONG *jaw-type clutch* has built-in non-repeat unit.

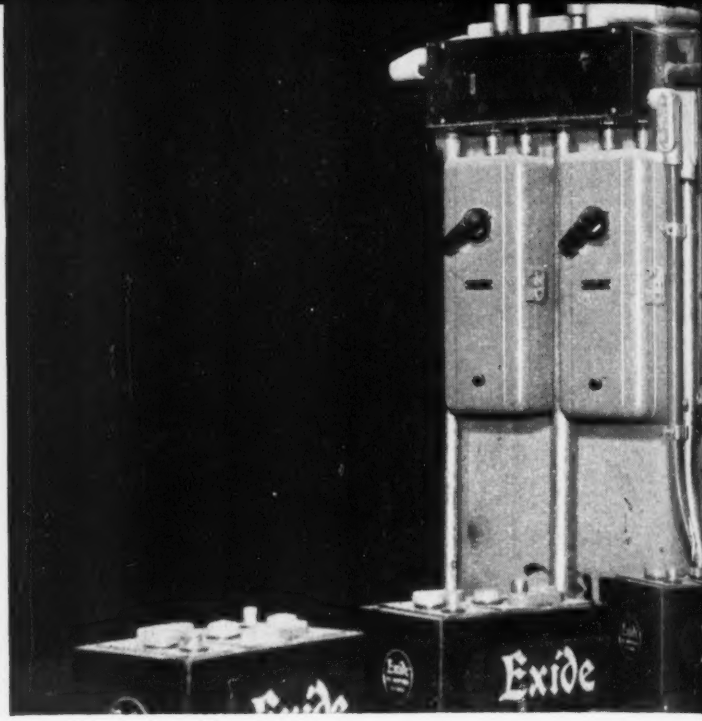
For performance . . . feature for feature and dollar for dollar, you can't beat the value of WYSONG squaring shears. Compare the WYSONG line with others in the field . . . and for shear satisfaction, buy WYSONG.

WYSONG builds Squaring Shears in cutting lengths from 3 feet through 12 feet, in motorized, air-power and foot-power models; O. B. I. Presses; Slip Roll Formers; and Rotary Combination Machines. See your dealer or write factory for full information.
Wysong and Miles Company, Greensboro, North Carolina

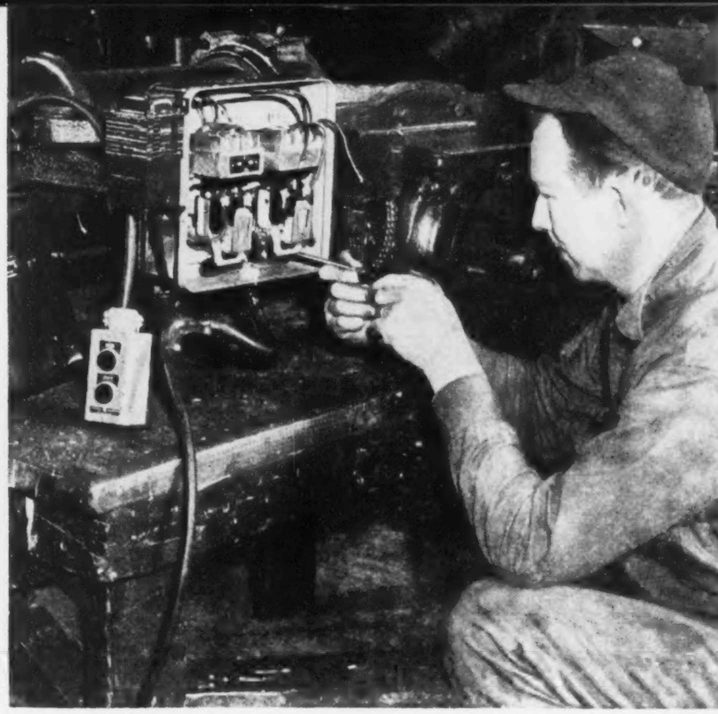
Illustrated above: Wysong No. 1025, Cap. 10 ft., ¼in., mild steel

WYSONG




Exide
Exide

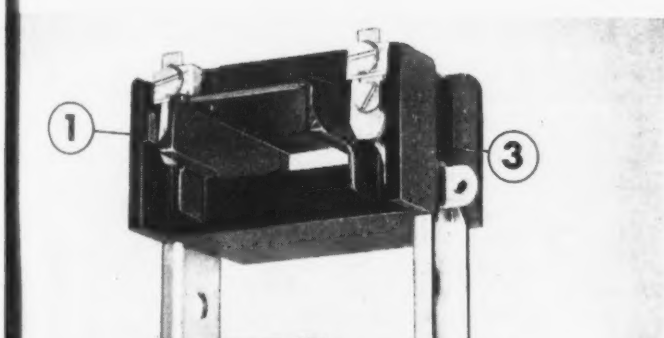
THE ELECTRIC STORAGE BATTERY CO. of Philadelphia, Pa. makers of Exide Batteries, chose General Electric magnetic starters to protect production flow. They report no shutdowns due to starter failure. Above, two G-E fusible combination starters are used in key section of an Exide production line.



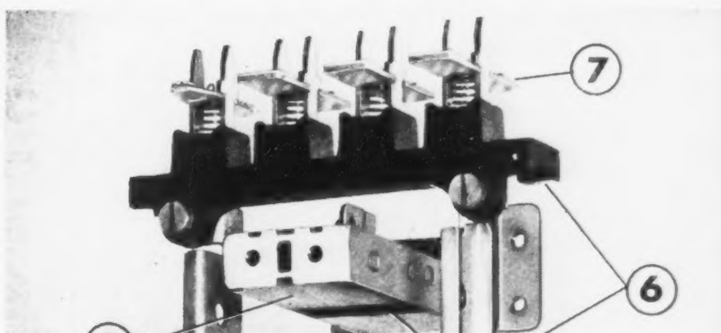
ELECTRO-LIFT, INC. of Bloomfield, N. J. makes motorized hoists which are subject to continual start-stop operation. They use G-E magnetic starters to assure unfailing operation to their customers, and to speed their own production. Ample wiring room and large pan-head screws, all in front, mean fast, easy installation.

industrial plants report:

Starters keep production up!"



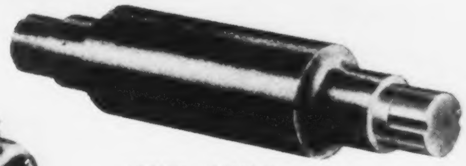
LONG LIFE is built right into the heart of G-E starters: the tough G-E *strongbox* coil (1). Winding is sealed in solid, molded plastic; dust, oil, moisture sealed out. This coil cannot be damaged by a maintenance man's screwdriver. Movable magnet of silicon steel (2) moves in straight line in permanently lubricated guides (3).



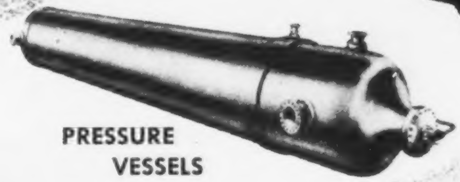
DEPENDABILITY is further assured by strong, simple construction. Magnets cannot stick shut because G-E starters have a *permanent* air gap (4) in stationary magnet. Gap never wears out—it is independent of striking surfaces (5). Unit construction (6) means no bearing pins. Note block of fine silver on contact tips (7).

GENERAL ELECTRIC

HEADQUARTERS FOR HEAVY STEEL FORGINGS



STEEL ROLLS



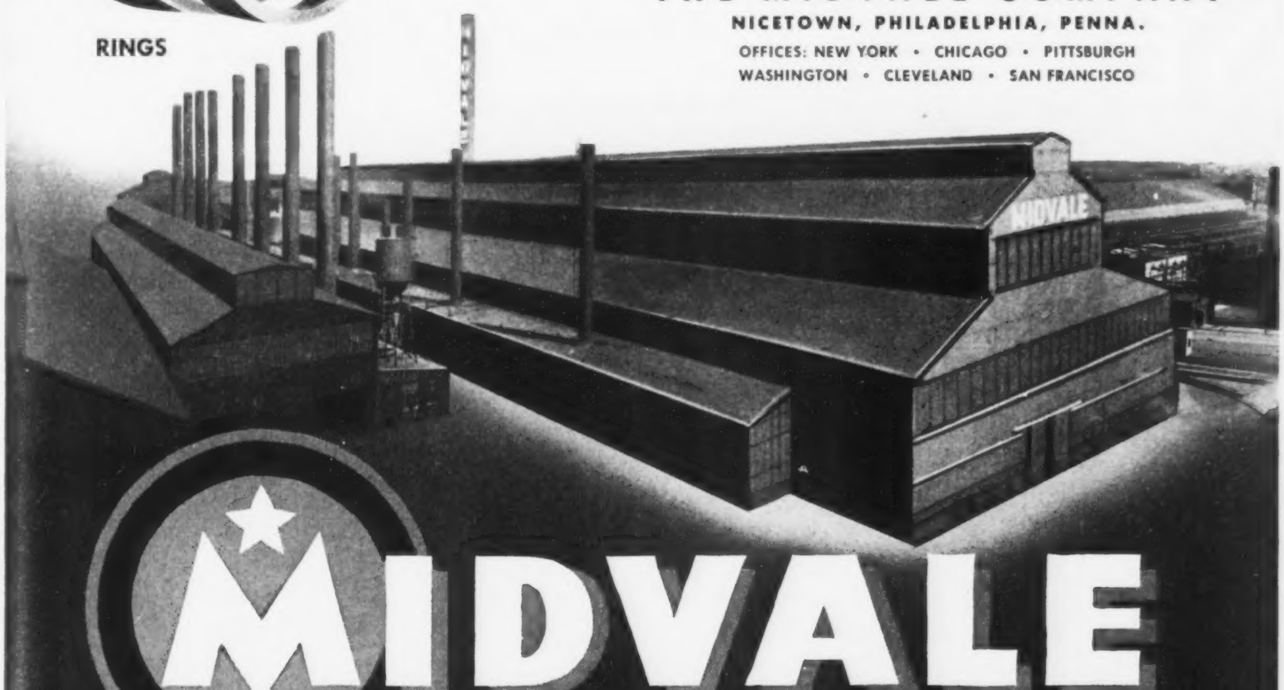
PRESSURE VESSELS

PRESS CYLINDER

RINGS

Whatever your needs for heavy steel forgings in industry, Midvale can assure you of the finest in craftsmanship, precision and ultimate performance. Whether it is weldless gear rings for turbine speed reduction . . . cylinders for hydraulic presses . . . weldless high-pressure vessels for oil refining, gas reactions and steam generation or hardened and ground steel rolls for cold rolling carbon and alloy steel, stainless steel, aluminum, copper, brass, zinc, foil, paper, linoleum, plastics and rubber . . . Midvale engineers can help you design them. Midvale craftsmen, with the most modern equipment, will build them to your most exacting specifications. Put your heavy forging problems in our hands.

THE MIDVALE COMPANY
NICETOWN, PHILADELPHIA, PENNA.
OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO



MIDVALE

Custom Steel Makers to Industry

PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

Case History IA-102

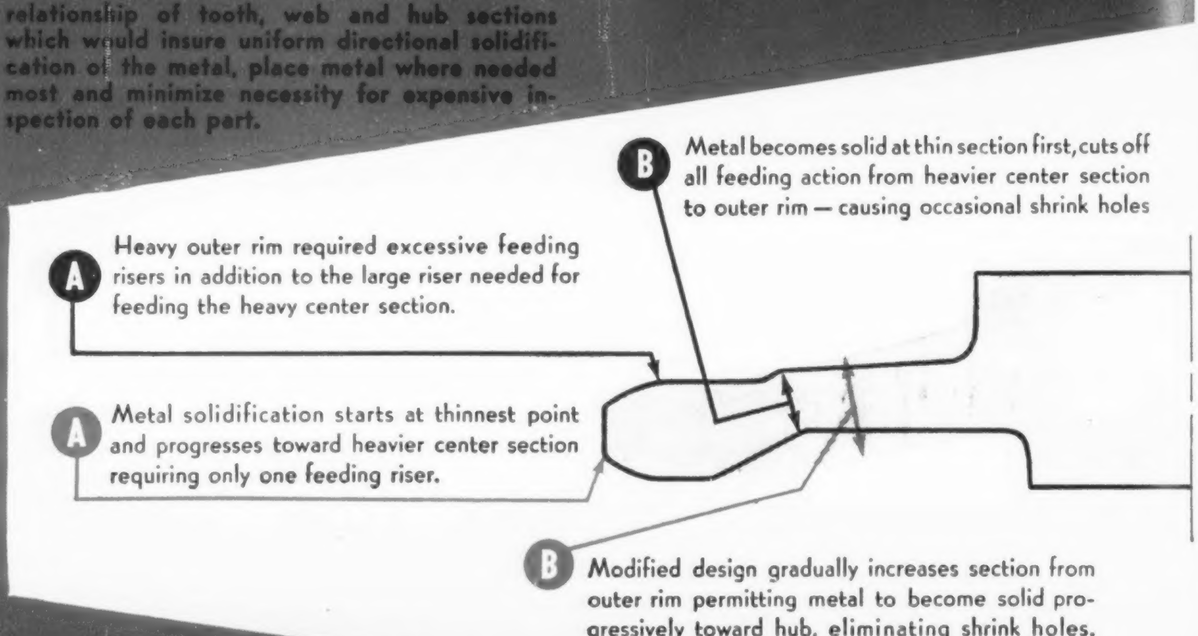
Here's what we mean by SUPERIOR ENGINEERED FOUNDRY PRODUCTS...

PROBLEM:

1. Conventional design of cast steel sprocket blank impaired proper directional solidification of the metal, causing uncontrolled shrinkage in the outer rim.
2. Assurance of delivery of sound castings was possible only through expensive non-destructive inspection of each blank.
3. Casting and machining losses were excessive.

OUR SOLUTION:

FOUNDRY ENGINEERED DESIGN to establish a relationship of tooth, web and hub sections which would insure uniform directional solidification of the metal, place metal where needed most and minimize necessity for expensive inspection of each part.



RESULT: 17.6% SAVINGS

1. Elimination of shrink holes in outer rim through proper directional solidification of the metal.
2. Elimination of need for expensive inspection of each part.
3. Reduced casting and machining costs.

BLACK LINES . . . ORIGINAL DESIGN
RED LINES . . . . . MODIFIED DESIGN

TOTAL COST OF PART REDUCED 17.6%

YOU TOO CAN GET SAVINGS LIKE THIS! CONSULT OUR PRODUCT DEVELOPMENT SECTION REGARDING YOUR PROBLEM . . . WHILE IT'S STILL ON THE DRAWING BOARD!

LET OUR FOUNDRY ENGINEERS HELP YOU CONSERVE CRITICAL MATERIALS

ENGINEERED FOUNDRY PRODUCTS

Since 1916

SUPERIOR STEEL AND MALLEABLE CASTINGS CO.

BENTON HARBOR, MICHIGAN, U. S. A.

How TIMKEN® bearings hold down screwdown maintenance

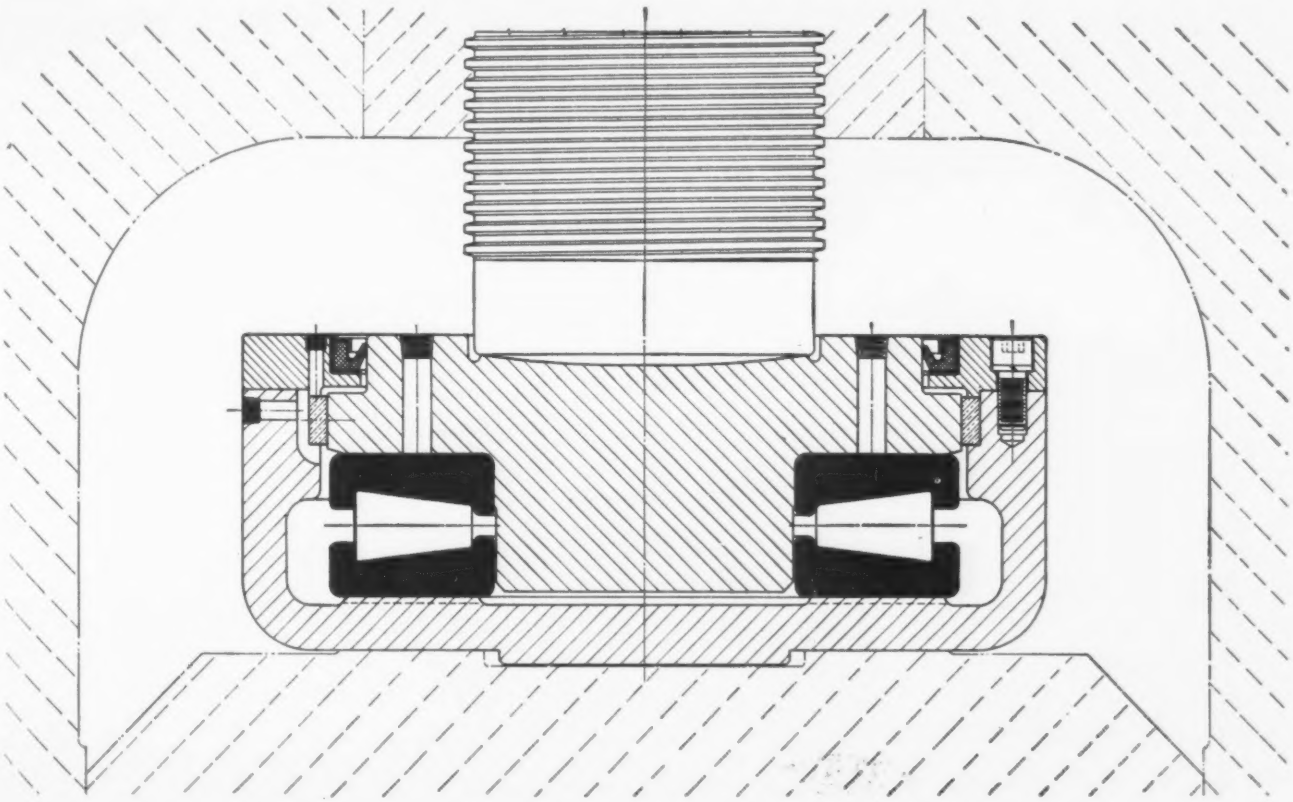
WITH Timken® flat thrust bearings installed on cold mill breaker blocks, screwdown maintenance is virtually eliminated. Timken flat thrust bearings take the terrific screw loads with minimum friction. Motor overload is drastically reduced, screwdown response is quick and uniform. There's no stripping of worm gears, no costly time-outs for lubrication.

Line contact between rollers and races of Timken bearings provides extra load-carrying capacity. Their incredibly smooth surface finish practically eliminates friction. On-apex construction gives them true rolling motion, eliminates skidding and skewing of the rollers.

Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel. And they're case-carburized to give them hard wear-resistant surfaces and tough, shock-resistant cores.

No other bearings give you all the advantages you get with Timken bearings. Always specify them for the machines you build or buy. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable Address: "TIMROSCO".

This symbol on a product means its bearings are the best.



Drawing shows how Timken flat thrust bearings are mounted on the breaker blocks of a 4-high cold mill to hold down screwdown maintenance and assure long, dependable operation.

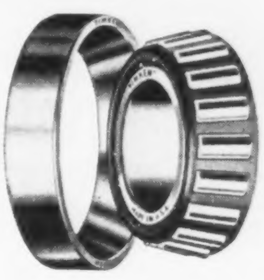
DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

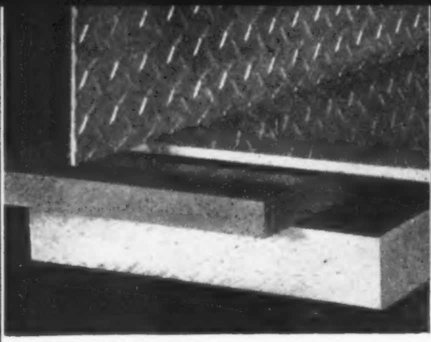
The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

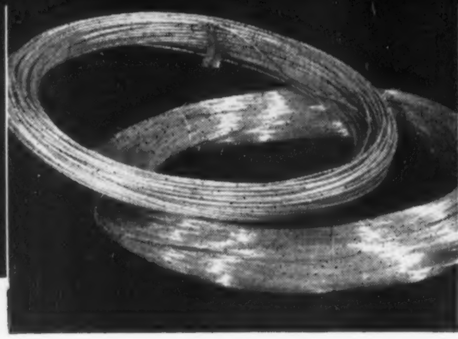
TAPERED ROLLER BEARINGS



NOT JUST A BALL · NOT JUST A ROLLER · THE TIMKEN TAPERED ROLLER · BEARING TAKES RADIAL · AND THRUST · LOADS OR ANY COMBINATION



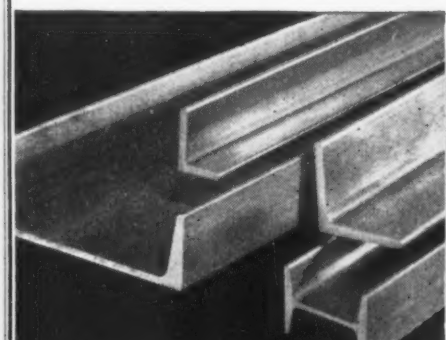
SHEET AND PLATE: Flat and coiled sheet; circles; patterned sheet; plate; tread plate; roofing and siding sheet; roofing accessories and fasteners; specialty sheet.



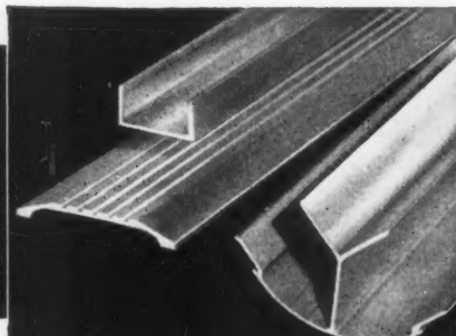
WIRE: Coiled and straight lengths; rivet wire; flattened and slit wire.

SCREW MACHINE STOCK: All free-cutting alloys plus the higher strength alloys—24S, 61S and 75S.

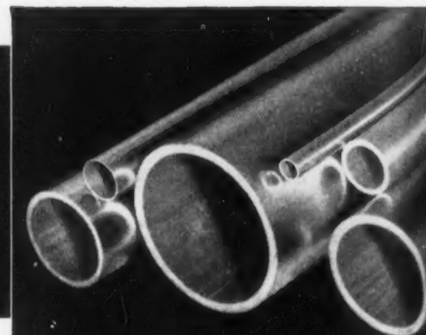
These are the MILL PRODUCTS of ALCOA



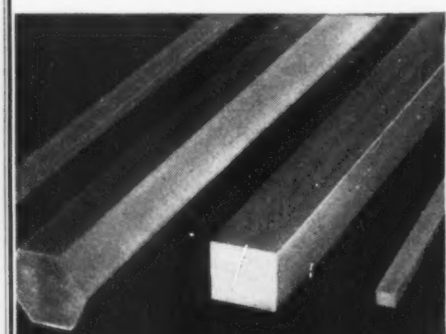
ROLLED SHAPES: Equal angles; unequal angles; channels; I-beams; H-beams; Tees; Zees.



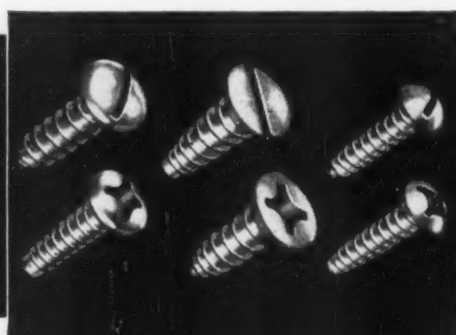
EXTRUDED SHAPES: Miscellaneous extruded shapes such as angles, channels, half rounds, quarter rounds, thresholds, truck corners and structural members, etc. Round, square, and rectangular bars.



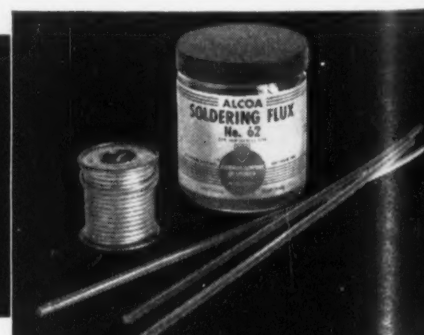
TUBE AND PIPE: Coiled tube; straight tube in round, square and rectangular shapes; heat exchanger tubes; standard pipe and pipe fittings; irrigation pipe; rigid conduit.



BAR STOCK: Square, hexagonal and rectangular bar stock in free-cutting and higher strength alloys.



FASTENERS: Machine screws; wood screws; washers; nuts; bolts; rivets.



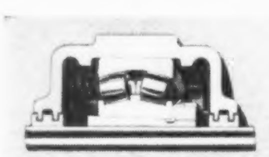
WELDING AND SOLDERING SUPPLIES: Welding and brazing wire; welding and brazing flux; solder flux; solder

ALUMINUM COMPANY OF AMERICA

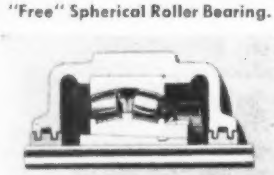
If dirt's your problem

here's the answer -

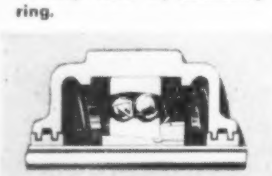
SKF TRIPLE-SEAL "SAF" PILLOW BLOCKS



"Free" Spherical Roller Bearing.



Same Pillow Block as above, Bearing "Held" by stabilizing ring.



"Free" Ball Bearing.

Same Pillow Block as above, Bearing "Held" by stabilizing ring.

Here's *why* the Series SAF Pillow Block is SKF's answer to your problems:

- Triple-Seal rotating rings give positive protection in dirty locations; effectively seal out foreign matter; seal in oil or grease.
- Stabilizing ring between the housing shoulder and the bearing insure fixed position of one held bearing on the shaft and prevents end movement of the shaft.
- Adapter-type bearings permit use of standard shafting, yet provides a ***tight fit.***
- Easy to install and inspect; self-aligning.

Write SKF for Folder No. 340 (for complete details), or contact your SKF Distributor.

SKF INDUSTRIES, INC., PHILA. 32, PA. — *manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*

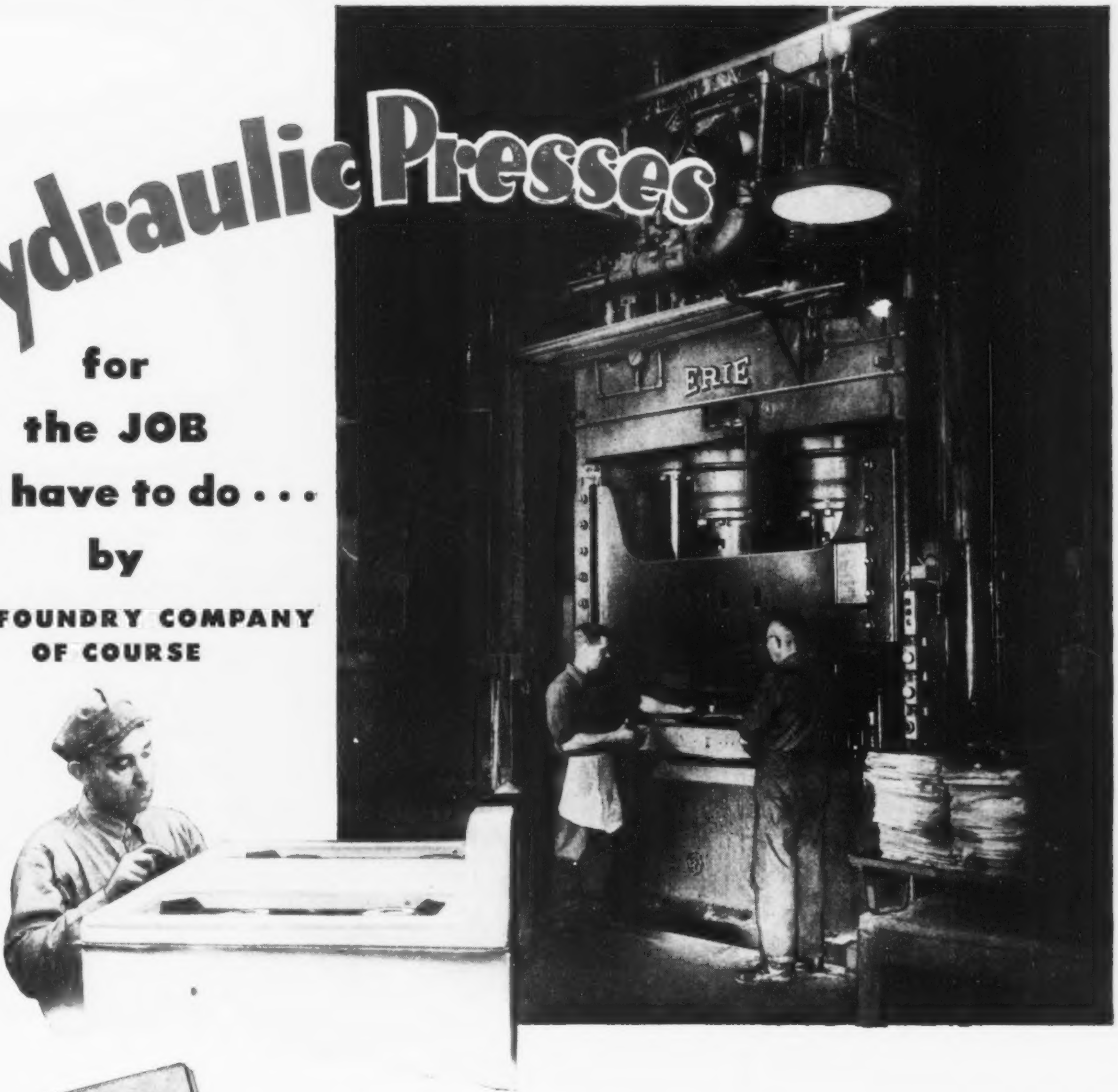
SKF®

BEARINGS AND PILLOW BLOCKS

Hydraulic Presses

for
the JOB
you have to do . . .
by

ERIE FOUNDRY COMPANY OF COURSE



• 335 TON FAST ACTION HYDRAULIC PRESS . . .

AT ODIN STOVE MANUFACTURING CO.

THIS Erie Foundry Company Hydraulic Press is typical of the diversity of design and construction available to you in selecting presses best suited to your product. It is forming the smooth, well contoured parts of the famous Odin Beautyrange. Bulletin 350 gives you a clear idea of our ability to meet your hydraulic press requirements. Your copy is ready to be mailed on request.

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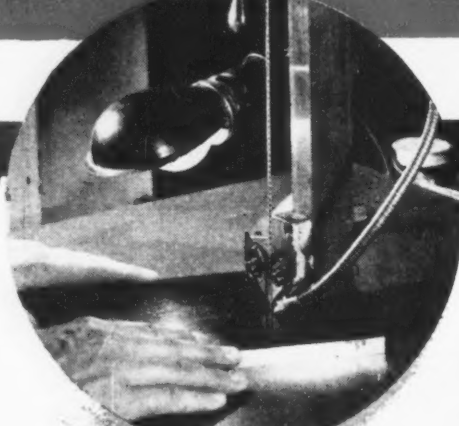
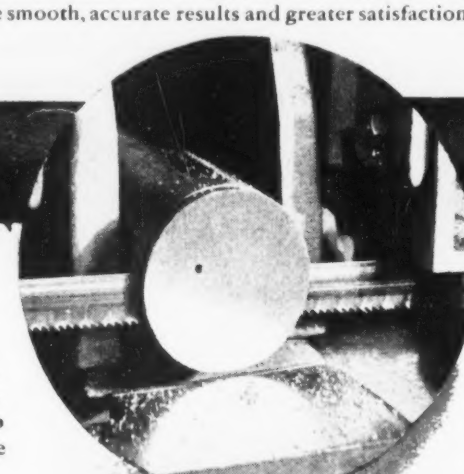
Get a Longer Run for your Money . . . with

SIMONDS METAL-CUTTING BAND SAWS



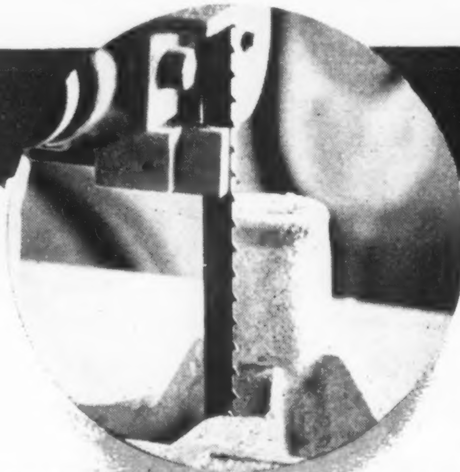
. . . for Contour Cutting

Made of tough, alloy steel that resists breaking, yet holds a keen cutting edge, Simonds Standard-Tooth Hard-Edge Band Saws in the narrower widths are outstanding favorites for contour work. That's why you'll find them so widely used in die-making and contour sawing of all kinds. Perfectly formed teeth, set with absolute evenness on both sides of the blade, insure smooth, accurate results and greater satisfaction



. . . for Horizontal Cutting

In the wider widths, these rugged, long-lasting Hard-Edge Blades are "tops" for use on horizontal machines, cutting off bars, tubing, angle iron, etc. Furnished either Regular Set or Wavy Set to handle the variety of cutting encountered in steel warehouses and general shop work. Hardy new 100' and approximately 300' coil containers insure factory perfect saw blades. Welded-to-length saws also supplied.

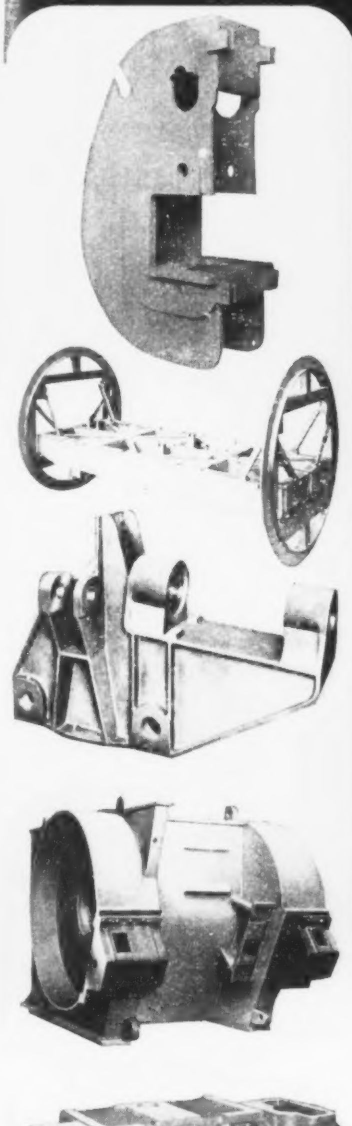


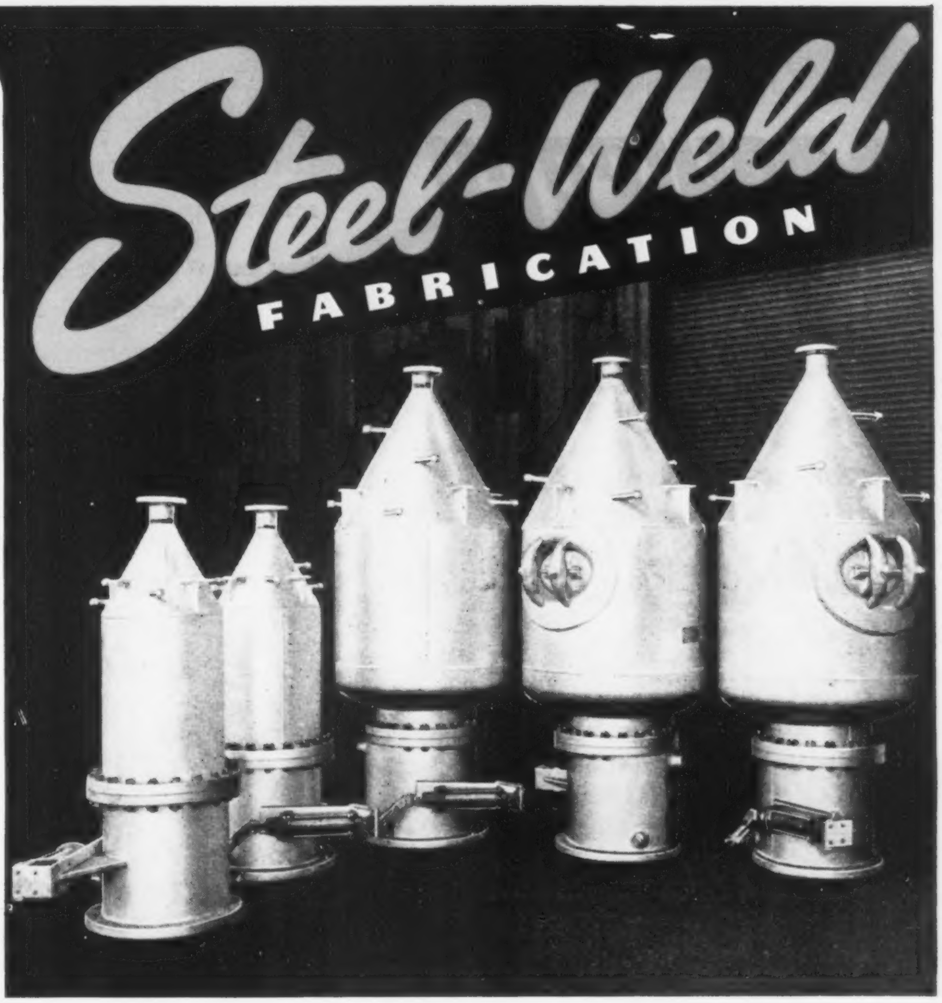
. . . for Non-Ferrous Cutting

Simonds Hard-Edge Skip-Tooth Band Saws are especially adapted for use on soft materials such as aluminum, magnesium, plastics, and hardwoods ...provide extra gullet capacity with maximum blade strength... are widely used in brass and aluminum foundries and plastic fabricating plants. Your Simonds Distributor will supply you with the right blade for your job.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que.
Southern Service Shop in Meridian, Miss. (formerly J. H. Miner Saw Mfg. Co.).
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.,
Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada





Use WELDED STEEL for Greater Strength with Less Weight!

Illustrated above are parts of a pneumatic pipeline conveying system. Each unit embodies an Air Operated Swing Check Valve and Lower Pressure Chamber. These completely machined and assembled units, together with those at the left, are presented as further evidence of the versatility of the Mahon organization in producing and machining Steel-Weld Fabricated parts and assemblies for hundreds of manufacturers throughout the country. If you have parts or assemblies in your product that could be redesigned and produced to better advantage from a strength—weight—bulk standpoint, or, if you are faced with a limited production on an item involving heavy pieces in which pattern costs are a consideration, you can turn to Mahon with confidence. You will find in the Mahon organization a unique source with complete, modern fabricating, machining and handling equipment to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures you a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

POWERED FOR PRODUCTION

WARNER & SWASEY SADDLE TYPE TURRET LATHES deliver tremendous power for the toughest jobs. The one-piece bed, with integrally cast head and VEE-WAYS, carries massive solid weight at the right places. And with diagonal cross-ribbed reinforcing it insures the rigidity that holds accuracy.

You can really hog off tough metal *fast* with any Warner & Swasey Heavy Duty Machine. You can give the job everything that carbide tooling can take.

And along with power, these machines have an industry-wide reputation for *holding* their precision accuracy. Warner & Swasey's are built to provide the right combination of power, speed and accuracy for the most rugged, heavy duty service throughout many years of trouble-free service.

WARNER & SWASEY
Cleveland

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS, AND TAPPING MACHINES


"THERE SHE BLOWS"
From one end of the oil country to the other, McKay Chain is at work helping hit pay sands. But then—you'll find McKay Chain everywhere doing the useful jobs of lifting, hauling, rigging, tying, spinning and other material and power transfer applications.
In every industry—there is a McKAY CHAIN FOR EVERY USE . . . no job is too big, none too small!
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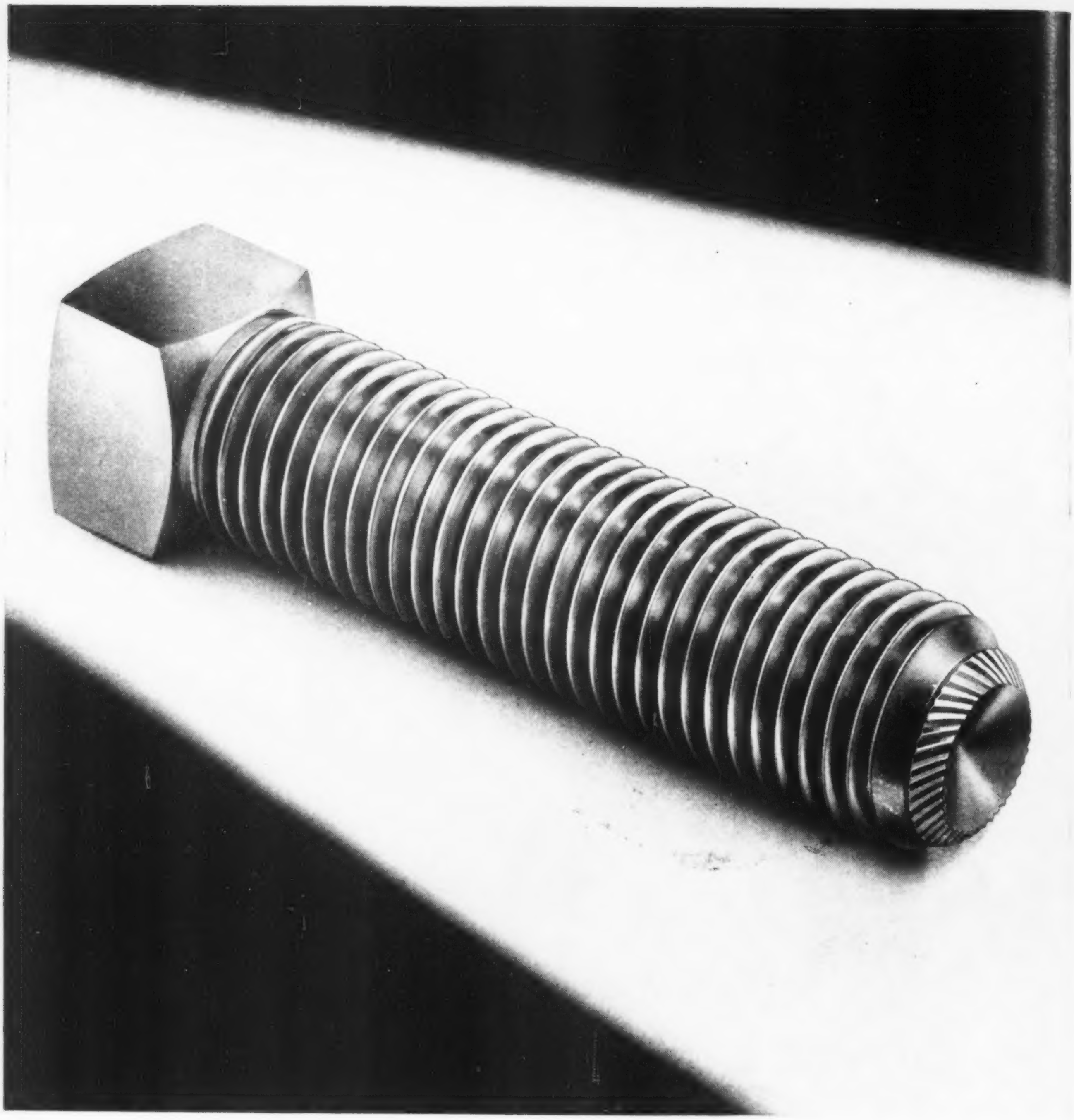


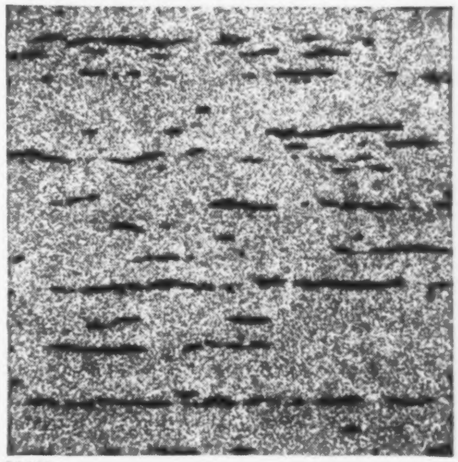
TESTS PROVE GRAPH-MO® BEST STEEL FOR GAGES!

Reports from users show Graph-Mo steel outwears other tool steel 3 to 1!

Graph-Mo® steel is today's big news for gage users and gage makers. The difference between Graph-Mo steel and other gage steels is so real you can see it—in the form of tiny, scattered, parallel marks barely visible on the surface of a polished piece of Graph-Mo. It's the "graphitic look"!

These marks indicate the presence of free graphite in the steel's structure. And this free graphite, together with diamond-hard carbides, enables Graph-Mo to outwear other tool steels an average of 3 to 1 according to reports from dozens of gage users. Tests prove Graph-Mo is also the most stable gage steel ever made. (see below).

Photomicrograph at right shows the free graphite and diamond-hard carbides that give Graph-Mo unusual wear resistance. They minimize scuffing, pick up and galling, and resist abrasion. Graph-Mo machines 30% faster than other tool steels, gives uniform response to heat treatment, and is available *now!*



100X

12-year stability test proves Graph-Mo steel master gage stays within 10 millionths of its original dimension

Here's proof of Graph-Mo's outstanding stability. These measurements were taken on a typical Graph-Mo steel master plug gage over a 12-year period. They show only 10 millionths of an inch change after that time.

1940—1.73996 *1941*—1.73995 *1942*—1.73998 *1943*—1.73997
1944—1.73996 *1945*—1.73995 *1948*—1.73997 *1951*—1.73995

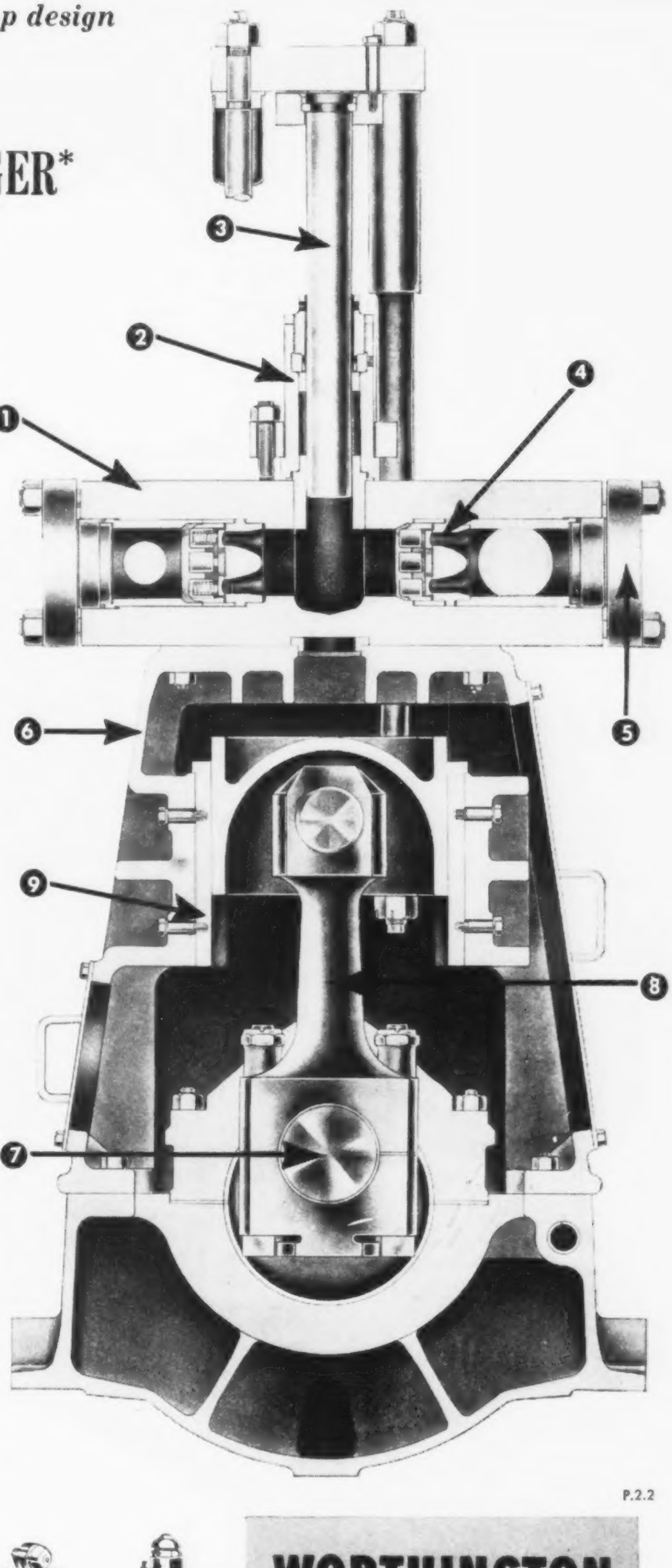
You can always tell Graph-Mo by its "graphitic look". This built-in "trade-mark", the result of the free graphite in its structure, can't be duplicated in other steels. Look for it, next time you buy gages. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

The inside story of a new power-pump design

THE WORTHINGTON HEAVY-DUTY MULTI-PLUNGER* VERTICAL POWER PUMP



To users of Worthington pumps, "heavy-duty construction" is almost taken for granted. But when Worthington engineers make a special effort to put *extra* ruggedness into a pump, you have something comparable to this Worthington Multi-Plunger Power Pump. Study the features and see for yourself!

ON THE LIQUID END

1. LIQUID CYLINDER—made of forged steel with large fluid passageways bored from solid forgings for maximum strength.

2. STUFFING BOXES—forged-steel barrels, bolted directly to cylinder with extra-deep boxes that permit maximum interchange of plunger sizes.

3. PLUNGERS—made from hardened and ground alloy steel or any other suitable metal. Solid ceramic plungers can be furnished for corrosive applications.

4. VALVE SERVICE—stainless-steel, heat-treated valves and valve seats. High-strength valve springs and bolted valve-hole covers.

5. INDIVIDUAL VALVE HOLE COVERS—one for each valve, permits quick and easy access.

ON THE POWER END

6. CAST-IRON FRAME—totally enclosed, with design that permits torque to be applied near foundation. All bearing surfaces and running parts pressure lubricated.

7. ONE-PIECE STEEL CRANKSHAFT—one-piece forged steel, accurately turned and ground to size. Heavy sections for minimum shaft deflection when loaded.

8. CONNECTING ROD—marine-type, forged-steel, with steel-backed, babbitt-lined crankpin bearings and solid bronze crosshead pin bearings.

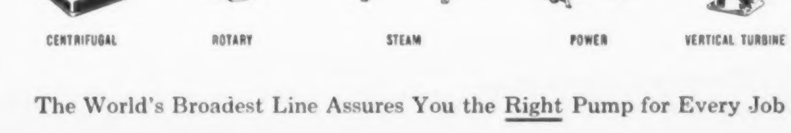
9. CROSSHEAD CRADLE LINERS—solid cast iron with bronze liner shim adjustable to permit careful alignment.

10. BRONZE-SHELL MAIN BEARINGS†—two-piece bronze shell design babbitt-lined with large bearing surface for longest-life. Precision made for trouble free operation.

If your application calls for a power pump of this size, *or any other size*, write, stating specific requirements, to Worthington Corporation, Reciprocating Pump Division, Harrison, New Jersey.

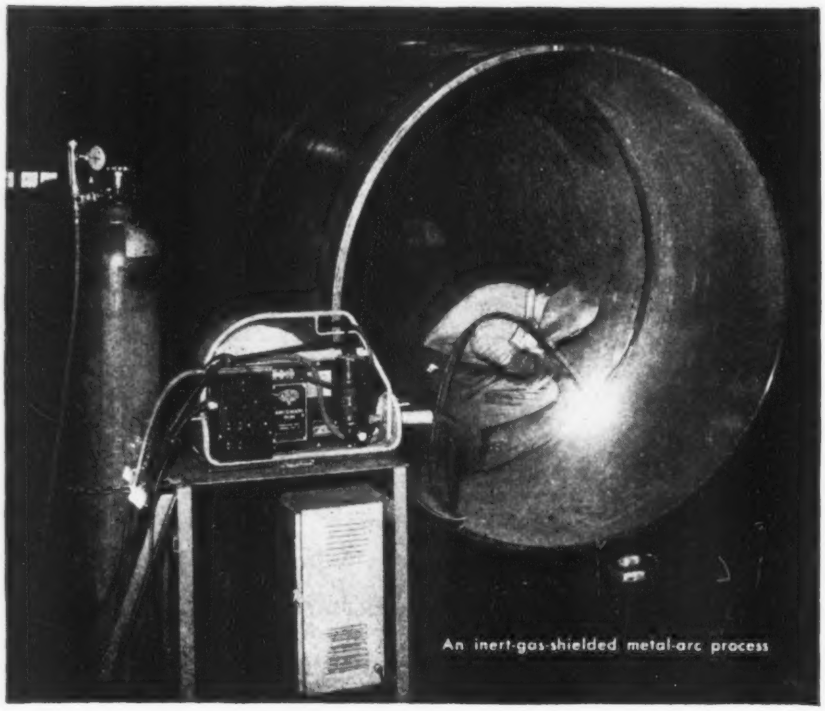
*available in 3, 5 or 7 plunger arrangements (300, 500, 700 hp)
†not shown in drawing

P.2.2



WORTHINGTON
Power Pumps

The World's Broadest Line Assures You the Right Pump for Every Job



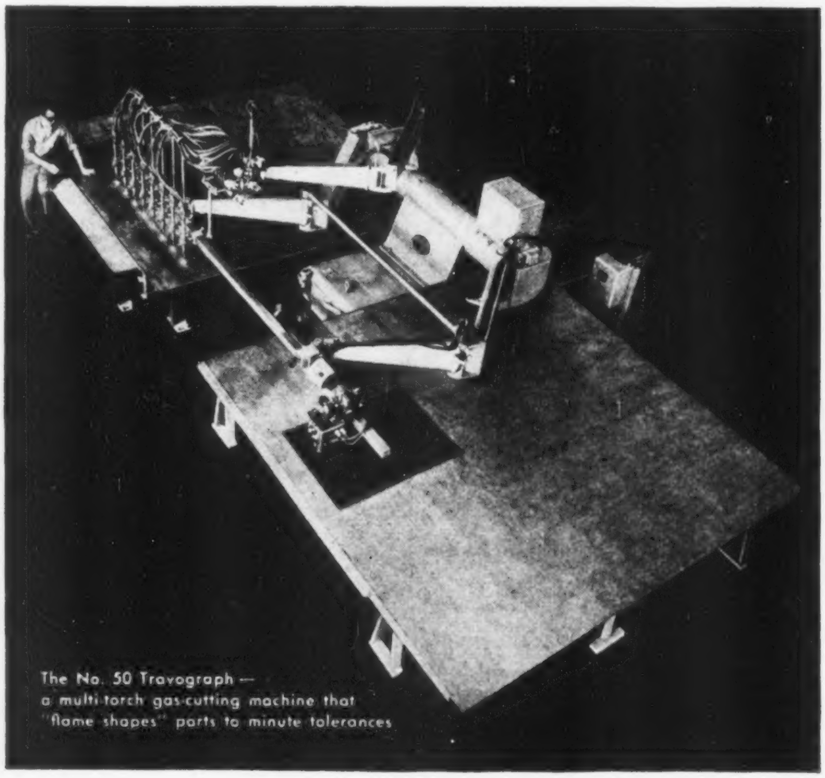
An inert-gas-shielded metal-arc process

AIRCOMATIC® WELDING

for hard-to-join metals

- Continuous high-rate deposition of filler metal
- Welds aluminum, bronze, nickel, stainless & carbon steels
- No flux required — no slag removal
- Minimum plate-edge preparation
- Heavy section welding with little or no preheat
- No "blind" welding — always a visible arc
- A semi-automatic operation with the versatility of all-position welding

AIRCO PRESENTS THE LATEST

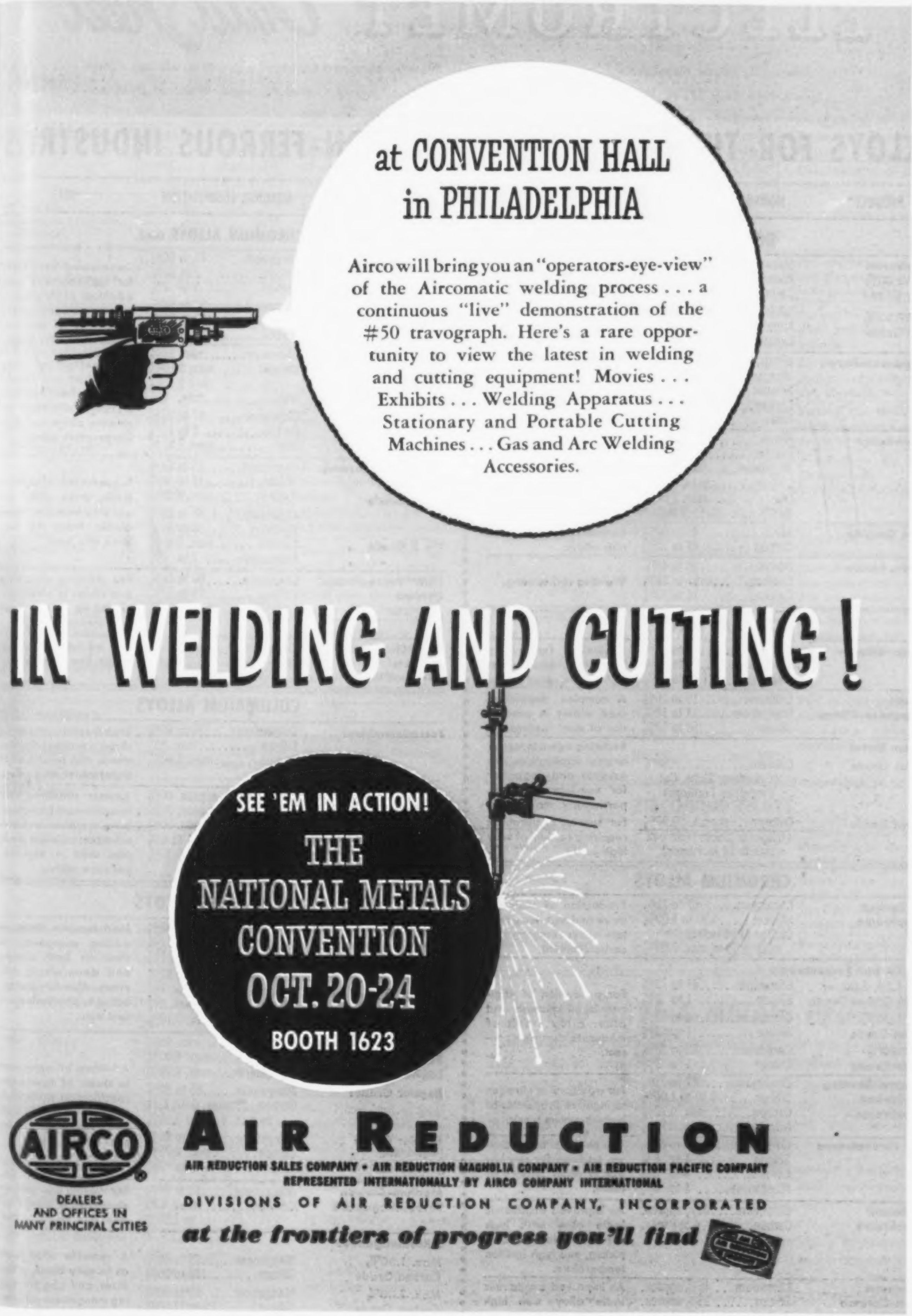


The No. 50 Travograph — a multi-torch gas-cutting machine that "flame shapes" parts to minute tolerances

TRAVOGRAPH® CUTTING

for mass producing intricate shapes

- "Electronic bloodhound" tracing device accurately reproduces template or outline drawings
- Handles light plates, heavy slabs, billets or forgings
- Straight cutting, beveling or squaring
- All-welded construction for durability and precision
- Torch arm will support up to 8 cutting torches
- Precision shapes up to 102" x 144" — circles up to 12' in diameter — with one 16' set of rails. Cutting length extended with additional rail


at CONVENTION HALL in PHILADELPHIA
Airco will bring you an "operators-eye-view" of the Aircomatic welding process . . . a continuous "live" demonstration of the #50 travograph. Here's a rare opportunity to view the latest in welding and cutting equipment! Movies . . . Exhibits . . . Welding Apparatus . . . Stationary and Portable Cutting Machines . . . Gas and Arc Welding Accessories.
IN WELDING AND CUTTING!
SEE 'EM IN ACTION!
THE NATIONAL METALS CONVENTION
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ELECTROMET *Data Sheet*

Published by Electro Metallurgical Company, A Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

ALLOYS FOR THE STEEL, IRON, AND NON-FERROUS INDUSTRIES

BORON ALLOYS

PRODUCT*	NOMINAL COMPOSITION	USES
Ferroboron Min. 10.00% Boron Grade	Silicon........max. 1.50% Aluminum.....max. 0.50% Carbon........max. 1.50%	Increases hardenability of steel; also, for additions to malleable iron and aluminum alloys.
Min. 17.50% Boron Grade	Silicon........max. 1.50% Aluminum....max. 0.50% Carbon.......max. 0.50%	
Manganese-Boron	Boron........min. 17.50% Manganese...approx. 75% Silicon........max. 1.50% Carbon..........max. 3% Iron............max. 5%	Used to cleanse and deoxidize non-ferrous alloys.
Nickel-Boron	Boron..........15 to 18% Silicon..........max. 1.50% Aluminum.....max. 1.00% Carbon.......max. 0.50% Iron..........max. 3.00% Nickel...........Balance	Special boron alloy used principally for deoxidizing nickel and its alloys.
Boron Carbide	Boron..........45 to 50% Carbon ....45 to 50%	Deoxidizer for non-ferrous alloys.
Calcium Boride	Boron..........38 to 42% Calcium........27 to 32% Carbon..........15 to 20%	Welding rod coating.

CALCIUM ALLOYS

PRODUCT*	NOMINAL COMPOSITION	USES
Calcium-Silicon	Calcium........30 to 33% Silicon..........60 to 65% Iron..........1.50 to 3%	Deoxidizer for quality ingot steel. Also used in high-tensile gray irons.
Calcium-Manganese-Silicon	Calcium........16 to 20% Manganese.....14 to 18% Silicon..........53 to 59%	A complex deoxidizer used widely in production of steel castings.
Calcium Metal Regular Grade	Calcium.............98% (Cylinders, Slabs, Cut Pieces, or Turnings)	Reducing agent in metallurgical applications, deoxidizer and degasifier for non-ferrous metals, particularly magnesium.
Distilled Grade	Calcium...approx. 99.90% (Irregular pieces from pea size to 14 in. lumps)	For special applications requiring calcium of very high purity.

CHROMIUM ALLOYS

PRODUCT*	NOMINAL COMPOSITION	USES
Low-Carbon Ferrochrome	Chromium......67 to 71% Silicon......0.30 to 1.00% Carbon (10 Grades) max. 0.03 to max. 2.00%	Production of stainless steels and high-temperature alloys requiring low carbon content.
High-Carbon Ferrochrome Max. 4.50, 5.00, or 6.00% Carbon Grade	Chromium......67 to 70% Silicon......... 1 to 2%	For production of engineering alloy steels and other alloy steels of moderate chromium content.
Max. 7.00% Carbon Grade	Chromium......66 to 69% Silicon......... 1 to 3%	
Min. 7.00% Carbon Grade	Chromium......65 to 68% Silicon......... 1 to 3%	
Nitrogen-Bearing Low-Carbon Ferrochrome	Chromium......67 to 71% Silicon......0.30 to 1.00% Carbon........max. 0.10% Nitrogen....approx. 0.75%	For additions of nitrogen to improve properties of high-chromium steels.
"SM" Ferrochrome	Chromium......60 to 65% Silicon .... 4 to 6% Carbon......... 4 to 6% Manganese..... 4 to 6%	A high-solubility chromium addition for steel or iron in either furnace or ladle.
Exothermic Ferrochrome	Chromium....60% approx. Carbon.........4.5% max.	An improved exothermic ladle alloy with high solubility, low carbon pickup, and high ignition temperature.
Exothermic Silicon-Chrome	Chromium... 46% approx. Silicon...... 23% approx. Carbon........1.00% max.	An improved exothermic ladle alloy with high solubility, very low carbon pickup, and high ignition temperature.

CHROMIUM ALLOYS cont.

PRODUCT*	NOMINAL COMPOSITION	USES
Foundry Ferrochrome High-Carbon Grade	Chromium......62 to 66% Silicon......... 7 to 10% Carbon......... 5 to 7%	Developed especially for high-solubility ladle additions of chromium to improve composition and properties of cast iron.
Low-Carbon Grade	Chromium......50 to 54% Silicon.........28 to 32% Carbon.......max. 1.25%	
Chromium Metal Low-Carbon Grades	Chromium.......min. 97% Carbon ......max. 0.10% and 0.50% Iron............max. 1%	Production of wide variety of non-ferrous chromium-bearing alloys, including electrical resistance alloys and high-temperature alloys.
High-Carbon Grade	Chromium......87 to 90% Carbon......... 9 to 11% Iron..........max. 1.25%	
"EM" Ferrochrome-Silicon No. 1 Grade	Chromium......39 to 41% Silicon.........42 to 46% Carbon.......max. 0.05%	In production of stainless steels, these alloys are used to reduce metal oxides from the slag back into bath.
No. 2 Grade	Chromium......36 to 39% Silicon.........36 to 39% Carbon.......max. 0.05% Aluminum...... 7 to 9%	
"EM" Ferrosilicon-Chrome	Chromium......50 to 54% Silicon.........28 to 32% Carbon.......max. 1.25%	For adding chromium and silicon to steels containing up to 1 or 2 per cent chromium.
"EM" Chromium Briquets (Hexagonal Shape)	Chromium...........2 lb. Total Weight.......3⅛ lb.	For adding chromium to cast iron in the cupola.

COLUMBIUM ALLOYS

PRODUCT*	NOMINAL COMPOSITION	USES
Ferrocolumbium	Columbium.....50 to 60% Silicon..........max. 8% Carbon.......max. 0.40%	Stabilizer in austenitic chromium-nickel stainless steels. Also constituent of high-temperature alloys.
Ferrotantalum-Columbium	Columbium...approx. 40% Tantalum.....approx. 20% Cb+Ta ....min. 60% Silicon...........4 to 6% Carbon.......max. 0.30%	Another stabilizer, used to supplement ferrocolumbium, in austenitic chromium-nickel stainless steels. Also used in high-temperature alloys.

MANGANESE ALLOYS

PRODUCT*	NOMINAL COMPOSITION	USES
Standard Ferromanganese Regular Grade	Manganese.....78 to 82% Carbon........approx. 7% Silicon..........max. 1%	Most common means of adding manganese to steel for both alloying and deoxidizing purposes. Also for counteracting sulphur in steel and cast iron.
Low-Phosphorus Grade	Manganese.....78 to 82% Carbon..........max. 7% Silicon..........max. 2% Phosphorus...max. 0.10%	
Low-Carbon Ferromanganese Low-Phosphorus Grade	Manganese......min. 90% Carbon........max. 0.07% Phosphorus...max. 0.06%	Additions of manganese to steels of low-carbon specification, particularly stainless steels of 18 per cent chromium, 8 per cent nickel type.
Regular Grades	Manganese.....85 to 90% Carbon ....max. 0.07, 0.11 to 0.15, 0.30, or 0.50%	
Regular Grade (High-Silicon)	Manganese.....80 to 85% Carbon........max. 0.75% Silicon......... 5 to 7%	
Medium-Carbon Ferromanganese	Manganese.....80 to 85% Carbon..........max. 1.25 to 1.50%	For making low- and medium-carbon manganese steel and Hadfield steel.
Silicomanganese Max. 1.50% Carbon Grade	Manganese.....65 to 68% Silicon.........18 to 20%	A versatile alloy useful as furnace block, deoxidizer, and also for making manganese additions to steel in the ladle or in the furnace.
Max. 2.00% Carbon Grade	Manganese.....65 to 68% Silicon......15 to 17.50%	
Max. 3.00% Carbon Grade	Manganese.....65 to 68% Silicon.......12 to 14.50%	

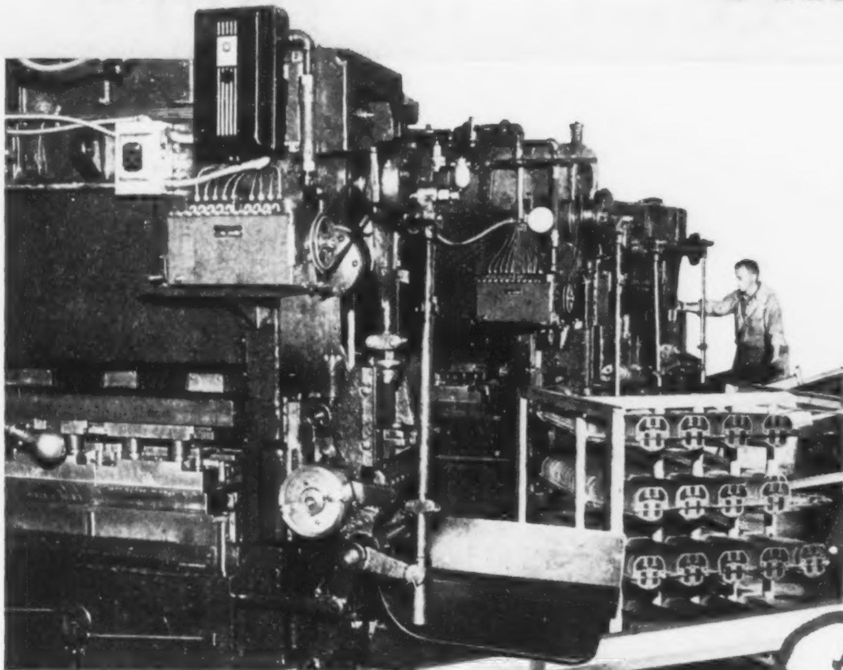
*All of the alloys and metals listed are produced in the usual lump, crushed, or ground sizes, except where other special forms are indicated.

PRODUCT*	NOMINAL COMPOSITION	USES
MANGANESE ALLOYS cont.		
Low-Iron Ferromanganese	Manganese.....85 to 90% Carbon.....approx. 7.00% Silicon..........max. 3% Iron............max. 2%	For high manganese additions to certain non-ferrous alloys, particularly aluminum.
Manganese Metal	Manganese......min. 96% Carbon.......max. 0.20% Silicon.......max. 1.00% Iron.........max. 2.50%	Used both as deoxidizer and alloy in production of numerous non-ferrous metals and alloys.
"EM" Silico-manganese Briquets (Square Shape)	Manganese..........2 lb. Silicon............½ lb. Total Weight.......3½ lb.	For adding manganese (with silicon) to cast iron in the cupola.
"EM" Ferro-manganese Briquets (Oblong Shape)	Manganese.........2 lb. Total Weight.........3 lb.	For adding manganese (without silicon) to cast iron in the cupola.
SILICON ALLOYS		
50% Ferrosilicon		
Regular Grade	Silicon.........47 to 51%	Deoxidizer for most grades of killed or semi-killed steel. Blocking grade specially sized for maximum efficiency.
Blocking Grade	Silicon........47 to 51%	
Low-Aluminum Grade	Silicon.........47 to 51% Aluminum.....max. 0.40%	
65% Ferrosilicon		
Regular Grade	Silicon.........65 to 70%	For furnace or ladle addition to carbon and alloy steels.
Low-Aluminum Grade	Silicon....61.50 to 66.50% Aluminum.....max. 0.50%	Mainly for production of electrical sheet steel.
75% Ferrosilicon		
Regular Grade	Silicon.........73 to 78%	Deoxidizer and alloy for production of high-silicon spring and electrical sheet steel. Graphitizing inoculant for cast iron.
Low-Aluminum Grade	Silicon.........73 to 78% Aluminum.....max. 0.50%	
85% Ferrosilicon		
Regular Grade	Silicon.........83 to 88%	Enables melter to add higher percentages of silicon without chilling metal in ladle. Graphitizing inoculant for cast iron.
Low-Aluminum Grade	Silicon.........83 to 88% Aluminum.....max. 0.50%	
90% Ferrosilicon		
Regular Grade	Silicon.........92 to 95%	Permits large additions of silicon without harmful chilling effect.
Low-Aluminum Grade	Silicon.........92 to 95% Aluminum.....max. 0.50%	
Silicon Metal		
Regular Grade	Silicon.....min. 97 or 96% Iron........max. 1 or 2%	Additions of silicon to non-ferrous metals, particularly aluminum and copper, to improve physical properties.
Purified Grade	Silicon....99.70 to 99.90% Iron.........005 to .015%	For applications in non-ferrous industry requiring silicon of high purity.
Low-Calcium Grade	Silicon..........min. 97% Iron............max. 1% Calcium.......max. 0.10%	For the production of high-silicon aluminum alloys where calcium is detrimental.
Low-Aluminum Grade	Silicon..........min. 98% Iron............max. 1% Aluminum.....max. 0.10%	For the production of silicon-copper alloys where aluminum is detrimental.
"SMZ" Alloy	Silicon.........60 to 65% Manganese..... 5 to 7% Zirconium...... 5 to 7%	Particularly strong graphitizing inoculant used in making ladle additions to cast iron.
Special Graphitizer	Ferrosilicon Compound	Deoxidizer and graphitizer for cast iron.
Magnesium-Ferrosilicon	Silicon.......approx. 46% Magnesium..approx. 8.5%	For ladle addition to cast iron to obtain special properties.
Barium-Silicon	Barium.........40 to 50% Silicon.........45 to 55%	For deoxidation of non-ferrous alloys.
"EM" Silicon Briquets (Cylindrical Shape)		
Large Size	Silicon.............2 lb. Total Weight.........5 lb.	For adding silicon to cast iron in the cupola.
Small Size	Silicon.............1 lb. Total Weight.......2½ lb.	

"Electromet," "EM," "SM," and "SMZ," are trade-marks of Union Carbide and Carbon Corporation.

PRODUCT*	NOMINAL COMPOSITION	USES
TITANIUM ALLOYS		
Ferrotitanium	Titanium......27 to 32% Carbon .....max. 0.10%	For stabilized austenitic stainless steels and high-temperature metals.
Silicon-Titanium	Titanium.......40 to 50% Silicon.........45 to 50% Iron............max. 3%	For additions of titanium to steels or non-ferrous alloys.
Manganese-Nickel-Titanium	Titanium.......43 to 48% Nickel.......approx. 25% Manganese......max. 8%	Deoxidization of nickel alloys.
TUNGSTEN ALLOYS		
Ferrotungsten	Conforming to A.S.T.M. Spec. A 144-39	For production of tool and die steels; also high-temperature alloys.
Tungsten Metal Powder		
Melting Grade	Tungsten....min. 98.80% Total Carbon..max. 0.25%	Production of tungsten steels and cast tungsten carbide.
Calcium Tungstate	Tungstic Oxide..68 to 72%	For making tungsten chemicals and other tungsten products.
Calcium Tungstate Nuggets	Tungstic Oxide..68 to 72%	Making tool steels and high-temperature alloys by direct reduction.
Ammonium Paratungstate	Tungstic Oxide.min. 88.7%	Intermediate for tungsten products.
VANADIUM ALLOYS		
Ferrovanadium	Vanadium......50 to 55% Carbon....max. 0.20, 0.50, or 3.00% Silicon.... max. 1.50, 2.00, or 8%	Production of tool and engineering steels, high-strength structural steels, non-aging rimming steels, and wear-resistant irons.
Vanadium Oxide Fused	V_2O_5...........86 to 89% Na_2O........approx. 10% CaO...........approx. 2%	For addition of vanadium to steel and for manufacturing catalysts.
Sodium Polyvanadate (Red Cake)	V_2O_5........approx. 85% Na_2O.........approx. 9% CaO..........approx. 2% H_2O.........approx. 2.5%	For manufacture of vanadium compounds, including vanadium catalysts.
High-Purity	V_2O_5......approx. 99.50%	
Ammonium Metavanadate	NH_4VO_3.........min. 99%	
ZIRCONIUM ALLOYS		
12 to 15% Zirconium Alloy	Zirconium......12 to 15% Silicon.........39 to 43% Carbon........max. 0.20%	This is a powerful deoxidizer. It also increases denth of hardening.
35 to 40% Zirconium Alloy	Zirconium......35 to 40% Silicon.........47 to 52% Carbon.......max. 0.50%	Deoxidizer for fine grades of alloy steels. Used for adding larger amounts of zirconium.
Nickel-Zirconium	Zirconium......25 to 30% Nickel..........40 to 50%	For deoxidizing and degasifying nickel alloys.

The trend is to more stampings WITH PRESSES...



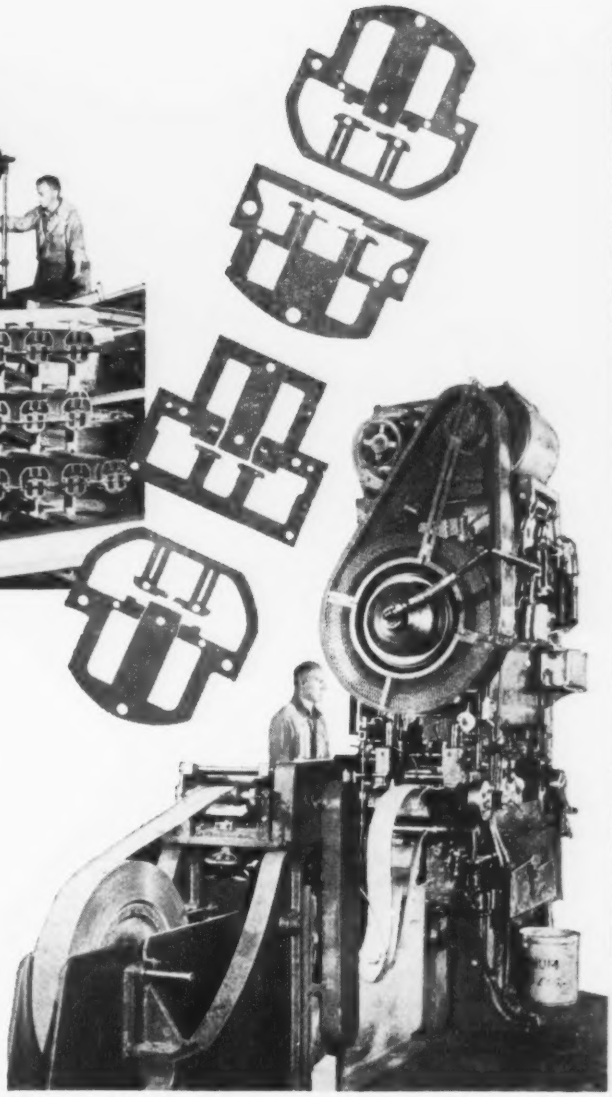
At Westinghouse Meter Division, Newark, N. J., Bliss Automatic Lamination line of four No. 645 High-Production Presses, operating at speeds in excess of 200 strokes per minute, steps up meter lamination production.

Westinghouse gets 800 laminations a minute from 4 BLISS Automatic Presses

To keep pace with stepped-up meter production, Westinghouse relies on a battery of four Bliss High-Production Presses for lamination stampings.

Production is fully automatic: 0.017 in. steel feeds from a Bliss-built coil cradle, through a double-roll feed into a six-station die. The stampings are stacked; the scrap is pulled through and trimmed...all at a rate of 200 strokes per minute.

These Bliss No. 645 Presses are but four of the 80 Bliss presses on the job at Westinghouse. That's because Bliss builds the most complete range of pressed-metal machinery available anywhere.



This completely automatic production unit includes coil cradle, roll straightener, double-roll feed, high-production shear and scrap press. For details on Bliss presses, write for "The Dominant Factor."

E. W. BLISS COMPANY, CANTON, OHIO

E. W. Bliss (England) Ltd., Derby, England

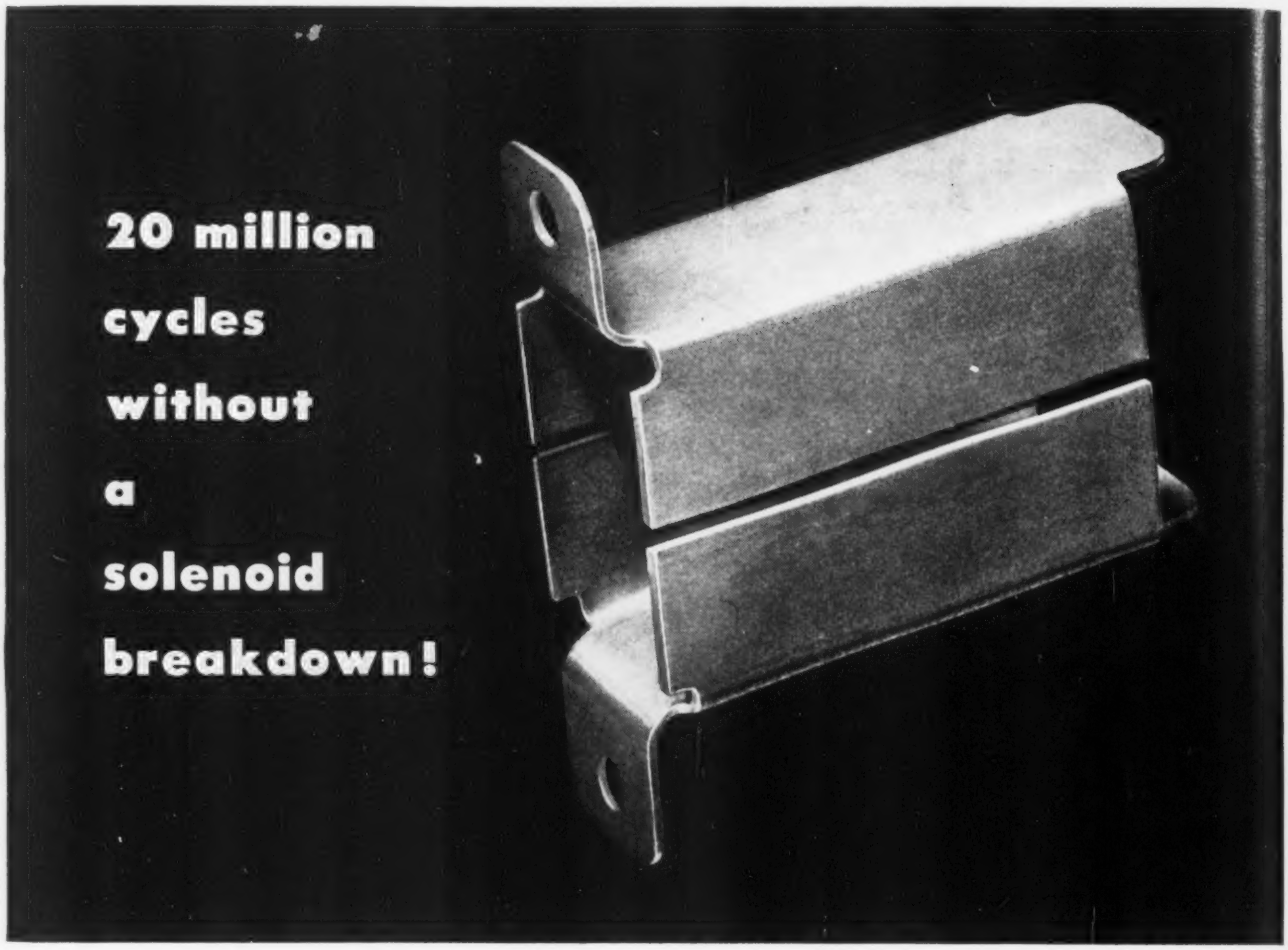
E. W. Bliss Company (Paris), St. Ouen sur Seine, France

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. **West Coast Representatives:** Moore Machinery Company, Los Angeles and San Francisco; Star Machinery Company, Seattle. **Other dealers** in U.S. cities and throughout the world.

BLISS

on your press is more than a name... it's a guarantee!



IT'S MADE OF BERYLCO BERYLLIUM COPPER

For safeguarding lives and property, brakes on a hoist are as essential as brakes on a car. Yale & Towne uses solenoids to actuate the brakes of its high-performance electric hoists. An integral part of the solenoid is the plunger guide shown here, made for Yale & Towne by the Instrument Specialties Co.

The plunger is made of laminated silicon steel and tends to exert a filing action on the guide, which is not lubricated. Under severe conditions, the plunger operates at 400 cycles per hour. Other materials tried in this application wore through, stuck, caused downtime and high maintenance costs. Stainless steel, for example, had a life of 250,000 cycles, phosphor bronze a life of 1 million to 2 million. Berylco was still going strong at 20 million cycles, at which point the test was discontinued. Maintenance costs dropped to a phenomenal 0.2% a year, largely due to the use of beryllium copper... and, of course, downtime was practically eliminated.

Resistance to wear is only one of the many outstanding properties of versatile **BERYLCO** beryllium copper. Others —such as high conductivity, elasticity and strength—can be obtained alone or in combination, depending upon the alloy selected. It will pay you to investigate what Berylco can do for you. Take advantage of the technical knowledge of the world's largest producer of beryllium copper. Blueprint your problem.

VALUABLE ENGINEERING INFORMATION

on Berylco beryllium copper is compiled in a series of monthly technical bulletins. To receive your copy regularly, write on your business letterhead.

SEE US AT BOOTH 1539

NATIONAL METAL EXPOSITION

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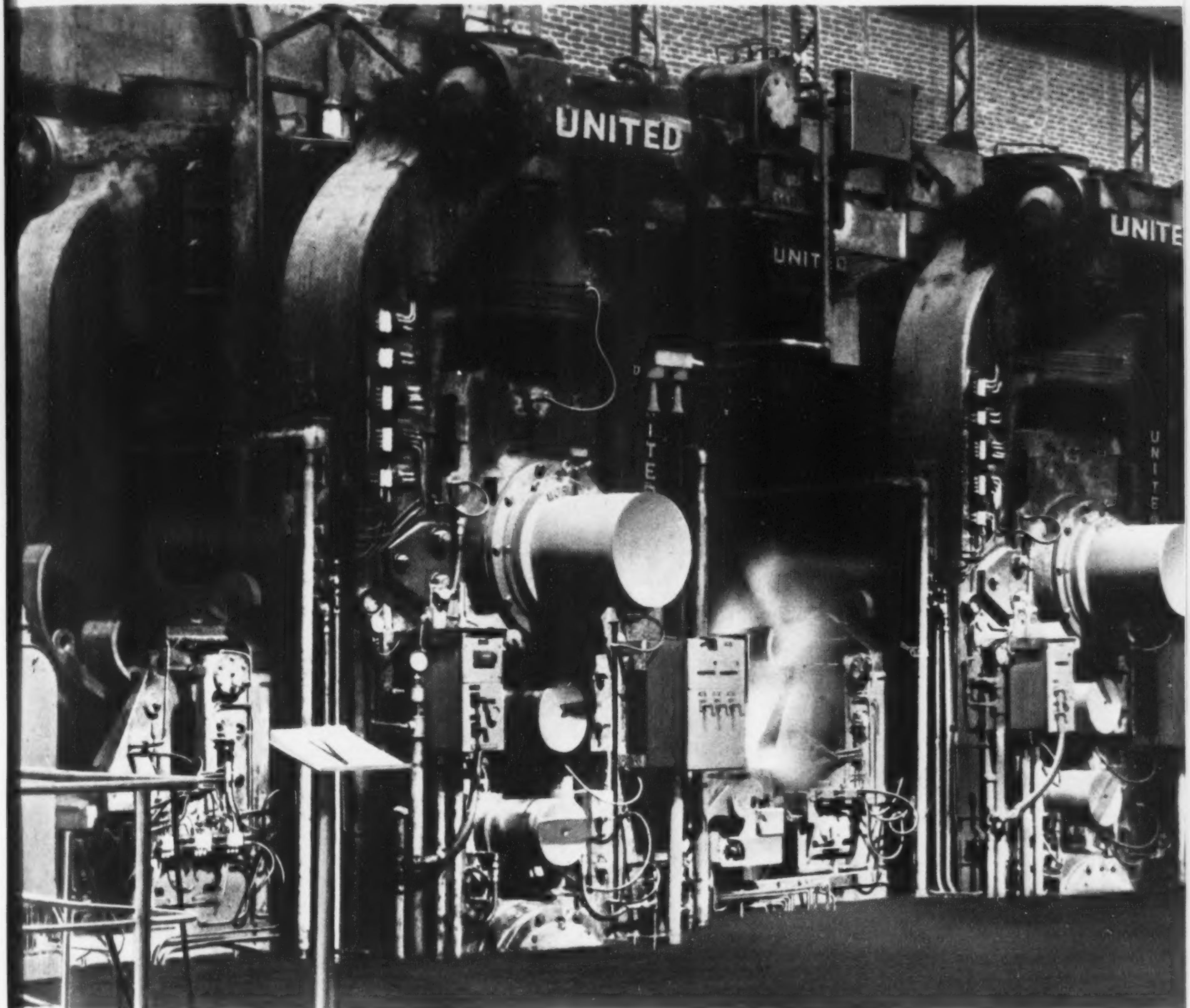

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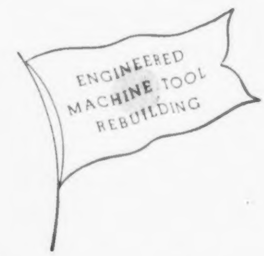
Designers and Builders of Ferrous and Nonferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other Heavy Machinery. Manufacturers of Iron, Nodular Iron and Steel Castings, and Weldments.

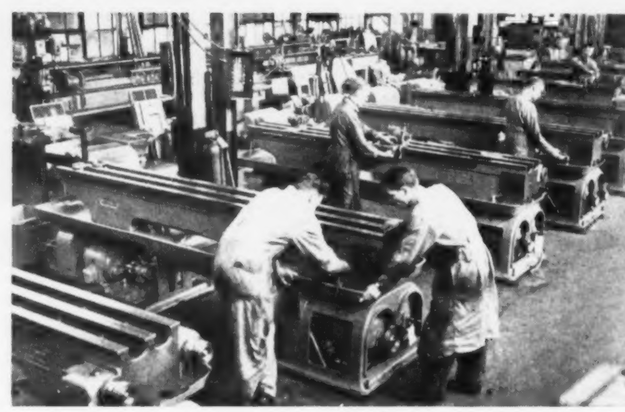
"Life Extension Institute" for Your Machine Tools



Speed was the problem here. As part of the Government machine tool re-activation program, Simmons has rebuilt over 400 machines. Shown in this bay (fore) are automatic screw machines, deep-hole drillers and various special tools. Despite this program, Simmons was able to continue its rebuilding for industry—thanks to its 120,000 square feet of plant capacity and diversified equipment.

Alignment of head and tail stock is part of the final test of this Landis grinder.

Sand blast facilities are maintained at Simmons to clean cast parts, remove inclusions.

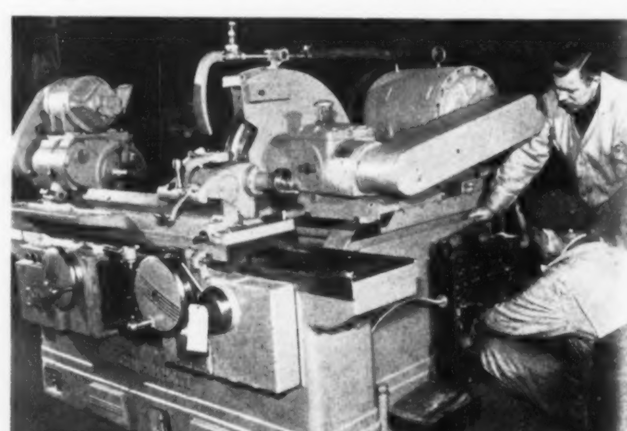


Modernizing: To adapt these deep-hole drillers for carbide tooling, speed was doubled from 1500 to 3000 rpm; cooling system pressure was increased; heavier electrical equipment installed.

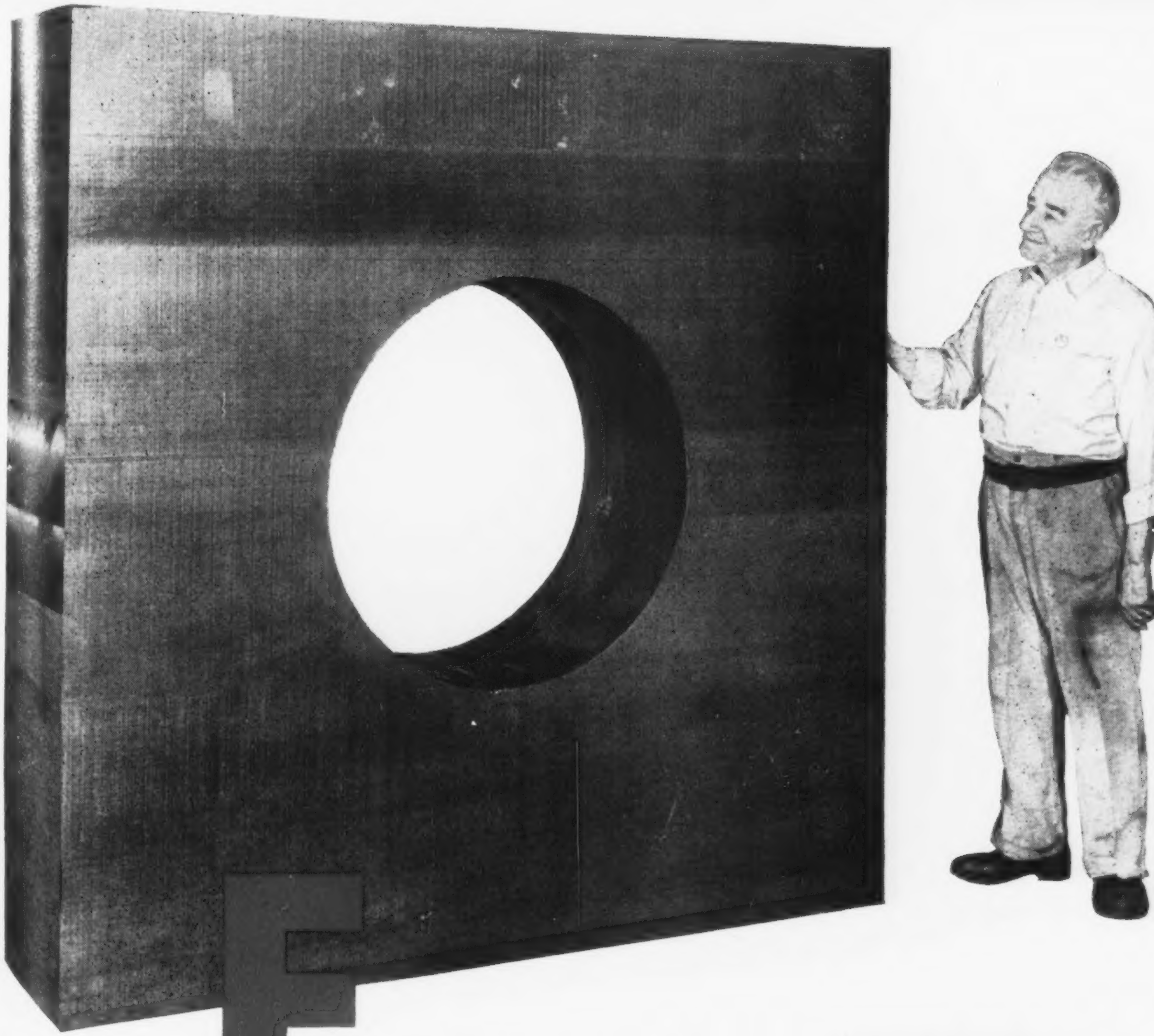
Rebuilding is the fastest way to get machine tools *today*. You will find that there are no long waits for delivery. *Engineered Rebuilding* guarantees user satisfaction. If you'd like to learn more about it, write for our quarterly, THE SIMMONS WAY.

SIMMONS MACHINE TOOL CORPORATION
1721 North Broadway, Albany 1, N. Y.

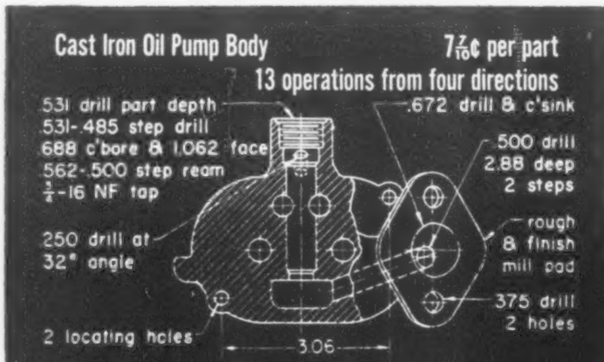
SIMMONS GIVES USED MACHINE TOOLS A NEW LEASE ON LIFE

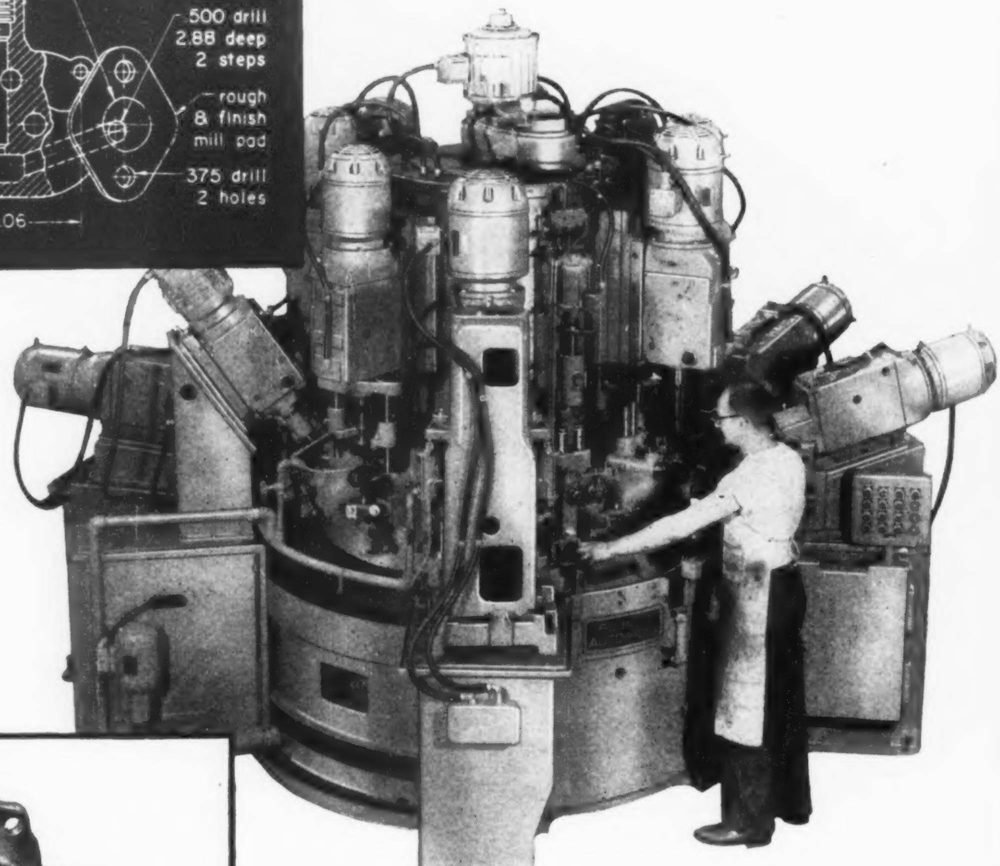


Checking electrical systems is an important part of Simmons *Engineered Rebuilding*. Here, two technicians check a control panel on a rebuilt Cincinnati grinder prior to inspection.



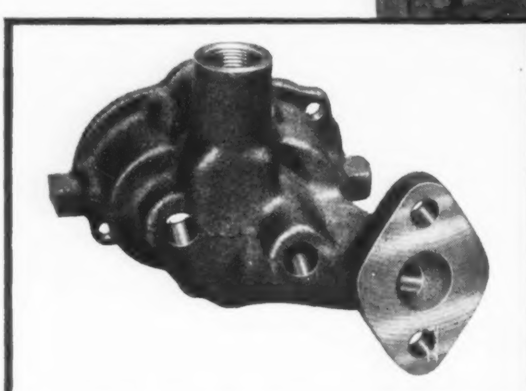
More parts per man-hour soon





13 Operations from 4 Directions 7 7/10¢ per part

Production is 200 parts per hour gross.



KINGSBURY Special Purpose Drilling and Tapping Machine Combines Operations to Save Money

Dear Sir:

Look at this Cast Iron Oil Pump Body. How many machines would *you* need to do all this work? One central column Kingsbury with an 84-inch base and 60-inch index table does all 13 operations. It has ten stations with 11 drilling units and one tapping unit. One unit has a two-spindle auxiliary head. Six units are mounted vertically. The other six units are mounted on knees bolted to the base and these are mounted at three different angles to the work.

The longest single operation governs the time required to finish one piece. By splitting a long operation into two short ones, using two units, the time cycle can be cut. Thus the .500 hole is drilled in two steps.

Bushing carriers guide all tools except the tap, the milling cutters and the second .500 drill. This means accurate alignment and precise positioning from the locating point. An interesting operation is the finish milling operation which has a special mechanism that draws the cutter away from the work on the up stroke. No tool marks to mar the finish.

take a CLOSER LOOK at...

for:

1. Seamless and welded Tubing.
2. Hot-finished, hot-rolled, cold-drawn or cold-rolled, and "Roto-Rocked" tubing.
3. Wide choice of Carbon, Alloy, and Stainless grades.
4. Sizes up to 9⅝" OD in full range of wall thicknesses.
5. Open-hearth and electric-furnace steels, including aircraft and magnaflux qualities.
6. Unannealed, annealed, tempered, normalized, or otherwise heat-treated conditions, as required.
7. Wide choice of surface finishes — as rolled, as drawn, as welded, flash removed, turned, scale-free, and polished.
8. Round, square, rectangular, oval, and other shapes.
9. Specialty fabrication such as upsetting, expanding, bending, safe-ending, and machining.

Headquarters for first-hand information on PRESSURE and MECHANICAL TUBING produced to meet your production problems.

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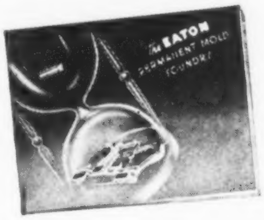
B&W SEAMLESS and WELDED TUBES

TA-1604

For better High Pressure Control Mechanisms

EATON

Permanent Mold Gray Iron Castings



Send for your copy of the illustrated booklet, "A Picture Tour of the Eaton Permanent Mold Foundry."

Free machinability
Dense, homogeneous structure
Freedom from leakage under pressure
Machines to high, mirror-like finish
Properly annealed; no growth or distortion after machining

EATON MANUFACTURING COMPANY
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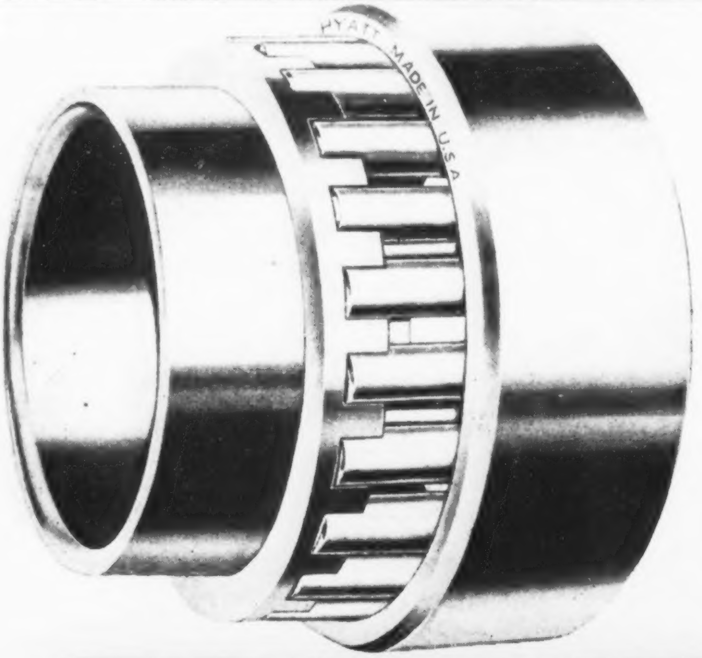
PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



Are you acquainted with this type of HYATT bearing?

Here is the Industrial Inch 70,000 Series three-part Hyatt Roller Bearing designed for large diameter, slow speed shafts in heavy equipment where fractional dimensions are the rule.

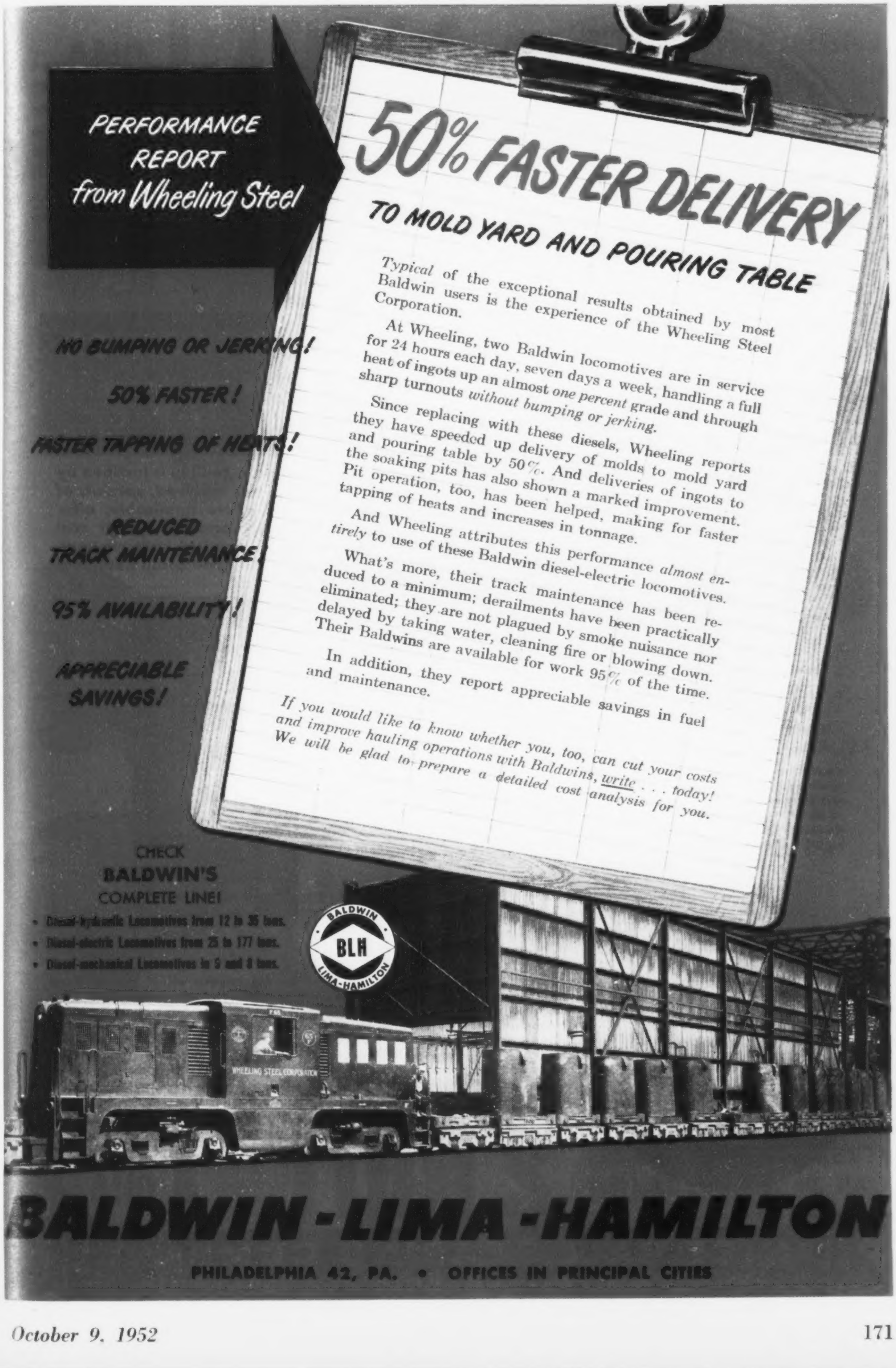
The races are made from alloy steel forgings which are heat-treated to obtain the greatest possible strength and durability, then finish-ground to close tolerances. The roller assembly is made up of two bronze end rings drilled to pocket the roller ends and riveted to steel spacing bars.

Built to fulfill specific requirements, this Industrial Inch Bearing, like all the other Hyatt Bearings employing solid or wound rollers, is proving most satisfactory for its particular application.

* * *

Write for Catalog No. 150 for further details in the Inch Series and all the other popular Hyatts for all your bearing needs. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS



PERFORMANCE REPORT from Wheeling Steel
50% FASTER DELIVERY
TO MOLD YARD AND POURING TABLE
Typical of the exceptional results obtained by most Baldwin users is the experience of the Wheeling Steel Corporation.
At Wheeling, two Baldwin locomotives are in service for 24 hours each day, seven days a week, handling a full heat of ingots up an almost *one percent* grade and through sharp turnouts *without bumping or jerking.*
Since replacing with these diesels, Wheeling reports they have speeded up delivery of molds to mold yard and pouring table by 50%. And deliveries of ingots to the soaking pits has also shown a marked improvement. Pit operation, too, has been helped, making for faster tapping of heats and increases in tonnage.
And Wheeling attributes this performance *almost entirely* to use of these Baldwin diesel-electric locomotives.
What's more, their track maintenance has been reduced to a minimum; derailments have been practically eliminated; they are not plagued by smoke nuisance nor delayed by taking water, cleaning fire or blowing down. Their Baldwins are available for work 95% of the time.
In addition, they report appreciable savings in fuel and maintenance.
If you would like to know whether you, too, can cut your costs and improve hauling operations with Baldwins, write . . . today! We will be glad to prepare a detailed cost analysis for you.
NO BUMPING OR JERKING!
50% FASTER!
FASTER TAPPING OF HEATS!
REDUCED TRACK MAINTENANCE!
95% AVAILABILITY!
APPRECIABLE SAVINGS!
CHECK BALDWIN'S COMPLETE LINE!
• Diesel-hydraulic Locomotives from 12 to 35 tons.
• Diesel-electric Locomotives from 25 to 177 tons.
• Diesel-mechanical Locomotives in 5 and 8 tons.
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WHEELING STEEL CORPORATION
BALDWIN-LIMA-HAMILTON
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Specialists IN "Specials"

"Specials" are ball bearings which have been custom designed to be "exactly right" for a particular application. Thus, the field for specials ranges from modification of existing standard bearings to complete new bearings of unusual shapes and dimensions. As "specialists in specials," experienced NICE engineers take advantage of every design opportunity to reduce costs without sacrifice of quality and to improve product performance and appearance.

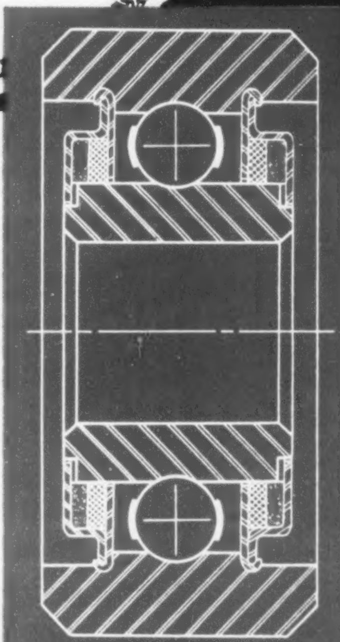
SPECIAL BEARINGS

of unusual shapes and dimensions

Representative of Nice ingenuity is No. 6866, a cam follower on an agricultural harvester. No. 6866 replaces a precision bearing pressed into a specially machined outer tire . . . and the resulting improvements were:

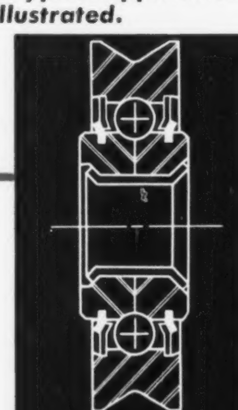
1. LOWER COST (OVER 30% SAVINGS).
2. INCREASED CAPACITY.
3. MORE EFFECTIVE SEAL.
4. PACKAGED INTERCHANGEABLE UNIT.
5. IMPROVED APPEARANCE AND PERFORMANCE.

Characteristic of agricultural machinery, severe dust and dirt problems dictated the need of an efficient and rugged seal. No. 6866 seal has proved to be highly effective and durable.



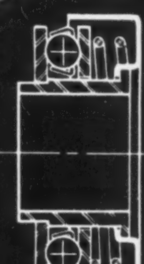
NO. 6866 CAM FOLLOWER

Where new tooling is justified by the quantities involved, specials of this type, where applicable, offer the greatest possibilities for cost savings and product improvement. A few typical application examples are illustrated.



No. 6750 BALING MACHINE WIRE GUIDE

SEMI-PRECISION "SPECIALS"



No. 6757 PRESSURE BEARING FOR LOCATING INSTRUMENT RECORDING CHART

Many precision bearing applications do not require all of the elements of precision that are normally incorporated in a standard precision unit. For example, if the bearing cone is locked against a step on the shaft, grinding of the bore can be eliminated and will save approximately 10% of the selling price of a 2" OD precision annular bearing. Similarly, if the loads are not severe nor the RPM excessive, polishing of the ball grooves may not be necessary and will reduce the cost about 10%. In a light load application, the outer ring material can be changed to a less expensive steel at a savings of as much as 8% of the selling price.

THE USE OF SEMI-PRECISION BEARINGS, WHERE INDICATED, MAY REFLECT SUBSTANTIAL SAVINGS TO THE MANUFACTURER WHO BUYS BEARINGS IN PRODUCTION QUANTITIES.

NICE

NICE BALL BEARING COMPANY
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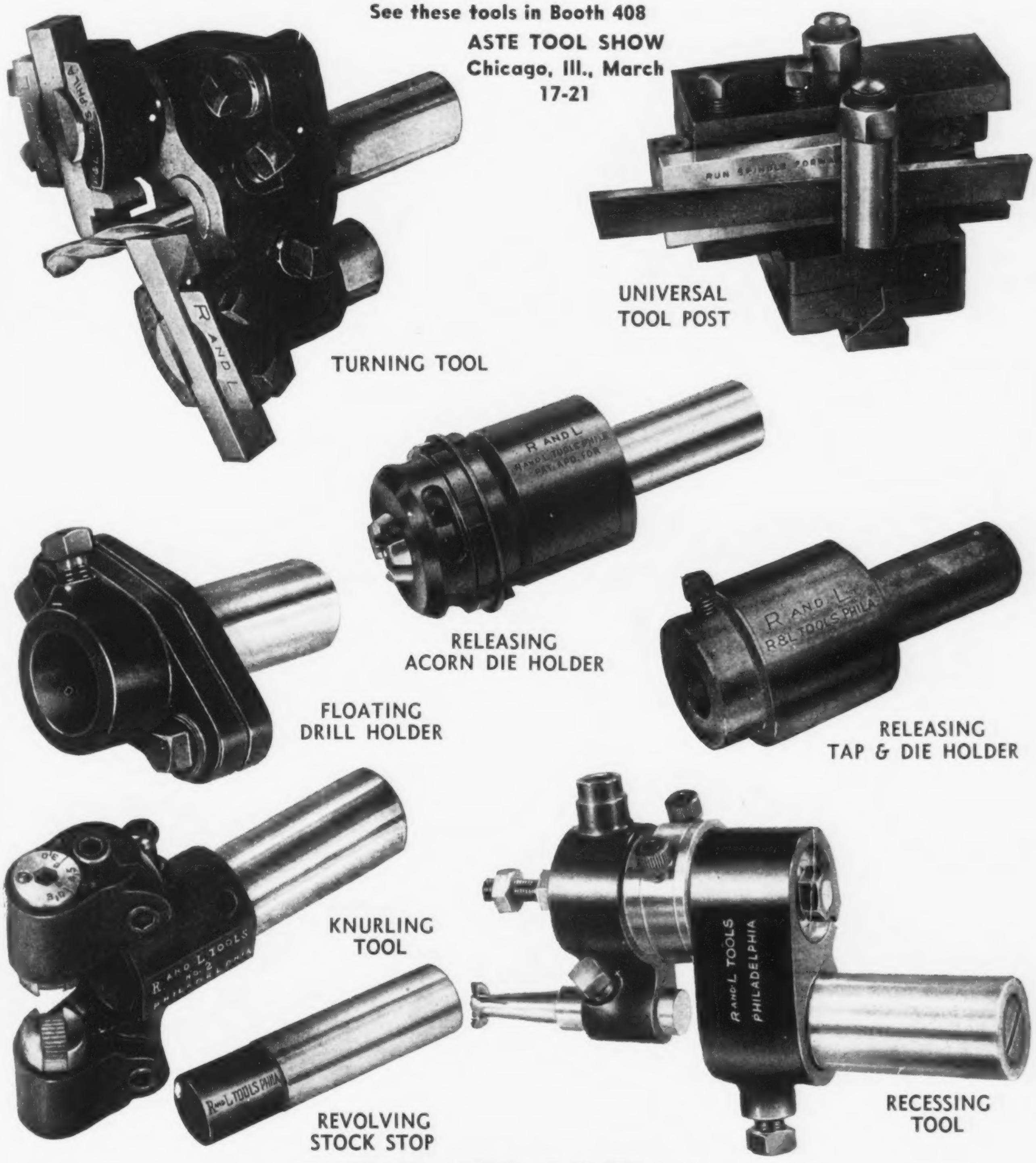
R AND L TOOLS

Manufacturers of Precision Screw Machine Tools

See these tools in Booth 408
ASTE TOOL SHOW
Chicago, Ill., March 17-21



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R AND L TOOLS

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RELEASING ACORN DIE HOLDER – REVOLVING STOCK STOP – FLOATING DRILL HOLDER – KNURLING TOOL – CARBIDE AND ROLLER BACKRESTS

Desand-degraphitize castings in 10 minutes with VIRGO® MOLTEN CLEANER

UNLOADING VIRGO-CLEANED CASTINGS from continuous cleaning line.

HERE ARE THE BENEFITS!

- **Longer machine tool life.**
- **All surface defects show up.**
- **A cleaner, better product.**

With Virgo Molten Cleaner your castings are completely free from sand and graphite before they are machined, giving you greater machine tool life. Any surface defects on castings are shown up, and you can scrap defective castings before they are machined. This same freedom from impurities insures trouble-free operation for your product when it is placed in use.

The process is simple and easy to operate—does not require close supervision. A five-minute immersion of castings in Virgo Molten Cleaner bath at 800° F. is usually enough to dissolve every trace of sand, and dissolve graphite to satisfactory depth. A water quench removes salt and leaves a protective coating on the castings. (This coating is corrosion-resistant and may be left on if castings are to be stored.) The coating is removed by a three-minute dip in dilute acid. A brief water hosing or rinse completes the job.

You can use the Virgo bath, at higher temperature, to stress relieve while desanding. By combining operations in this way, costly annealing equipment, as well as the additional operation can be eliminated.

For full details and description of this process, write us today. Please use your business letterhead or coupon below.

For Fast, Safe, Low-Cost DESCALING—VIRGO® DESCALING SALT

Producers and fabricators of stainless and alloy steels use Virgo Descaling Salt to quickly remove scale produced by hot rolling, forging, extruding, casting, annealing. The Hooker Process is backed by 15 years' experience in salt bath descaling and cleaning. Engineering, research and on-site operating assistance are part of our service.

SEND FOR THESE BULLETINS
They tell the whole story on Virgo Descaling Salt and Virgo Molten Cleaner—what they are, how they work, their advantages, equipment involved, and the Hooker services you enjoy as a user of the process.

HOOKER CHEMICALS ®

1-1949

From the Salt of the Earth

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33 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.
NEW YORK, N. Y.
WILMINGTON, CALIF.
TACOMA, WASH.
CHICAGO, ILL.

Hooker Electrochemical Company
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Please send me Bulletins checked: Virgo Descaling Salt ☐
Virgo Molten Cleaner ☐

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CITY ____________ ZONE ______ STATE ______

WELDERS

I DELTA Combination 5 KVA SPOT and 120 AMP. ARC WELDER

For any shop doing a lot of light duty production spot welding and intermittent arc welding. Unique design, careful engineering and high production methods permit pricing it considerably under two individual welders.

J DELTA 5 KVA Automatic SPOT WELDER

Compared to other spot welders, this compact unit is conspicuous for efficiency and low cost. It is extremely simple and easy to operate, and has an unusually wide range of capacity.

GRINDERS

K Toolmaker GRINDER

As a Chip-Breaker Grinder. With univise and coolant attachment, the Toolmaker surface grinder is a precision machine which grinds the chip breaker groove in carbide tipped tools.

As a Tool and Cutter Grinder. With the Toolmaker tool and cutter grinding attachment, it becomes an economical machine for easy sharpening of tools and cutters.

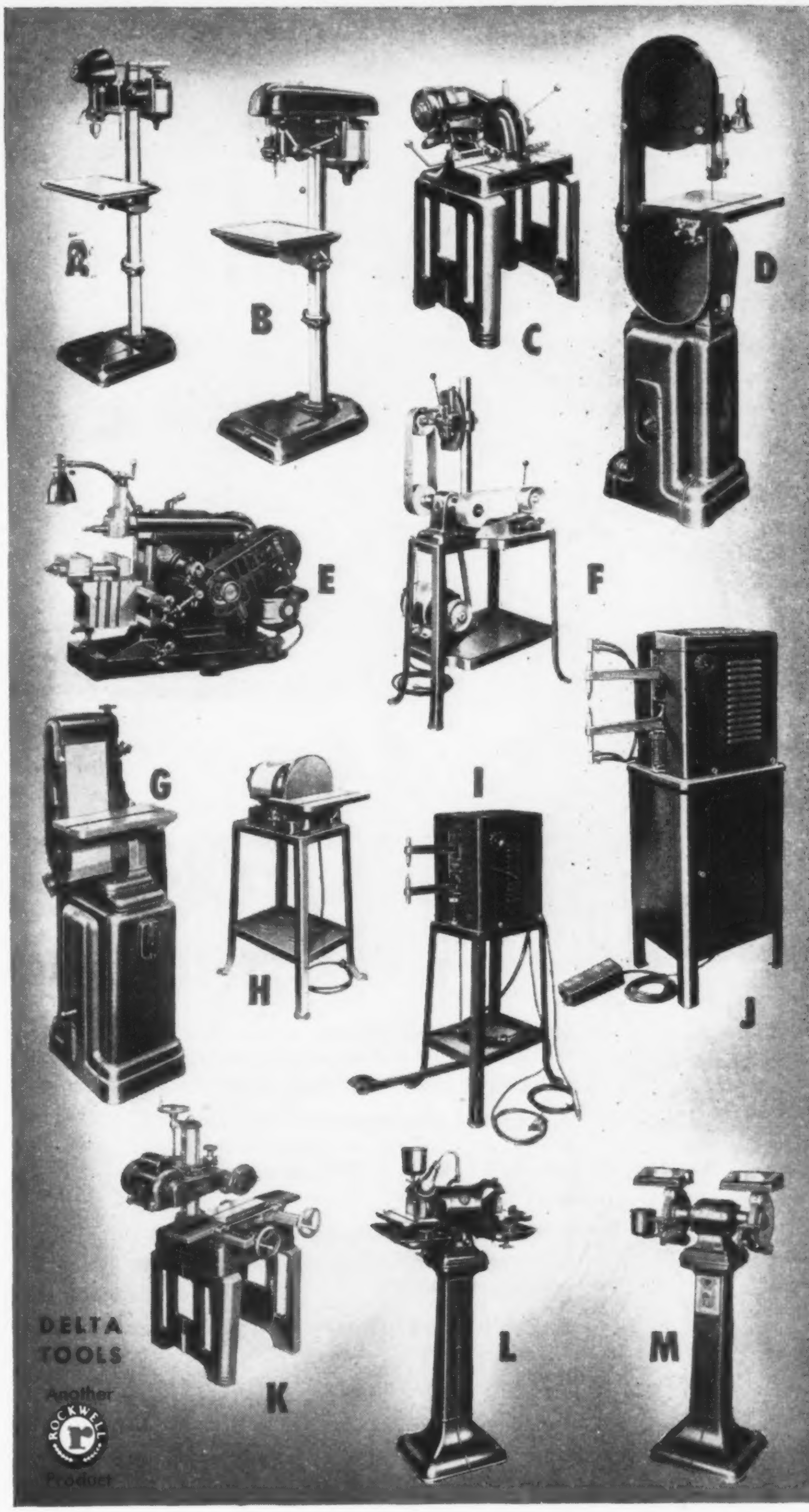
As a Standard Surface Grinder. The basic Delta Toolmaker surface grinder does every type of surface grinding required in the tool room or production shop. It's a big, rugged machine with the massiveness and solidity needed to produce accurate work.

L CARBIDE TOOL GRINDER

Here's the accurate, low cost way to grind your tungsten-carbide tools—the Delta Carbide Tool Grinder. Made in two styles—bench and pedestal—a wide range of motors are available.

M STANDARD TOOL GRINDER

Here's the grinder "that can't forget its goggles." In addition to its unsurpassed safety features, it's a money-saver—sturdy, accurate, highly adaptable, easy to use and low in cost.



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DELTA MILWAUKEE

DELTA POWER TOOL DIVISION

Rockwell Manufacturing Company

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BE SURE TO SEE
all of these tools demonstrated
under power at the
1952 METAL SHOW
Philadelphia • October 18-24 .

number 1 of a series

DIE CASTING is the Process...

2 ZINC, the Metal...

3 BUNKER HILL, the *Preferred* Zinc

DIE CASTING is the fastest of the metal casting processes. As a high production method, die casting ranks with stamping, powder metallurgy and screw machine production where large quantities of identical non-ferrous metal parts are required.

Aptly named "the shortest distance between raw material and finished product" die casting has proved itself as a high-speed, accurate, low-cost production tool. The extent to which industry adopted this high-efficiency process is evidenced by the rapid and phenomenal growth of die casting and its concurrent – and still growing – importance as a consumer of non-ferrous metals. In 1926, for example, only 13,000 tons of zinc were used for the manufacture of die castings. In recent years, the industry's annual consumption of Special High Grade Zinc has averaged nearly 300,000 tons – making the die casting industry the largest single user of "four-nines" zinc in the United States.

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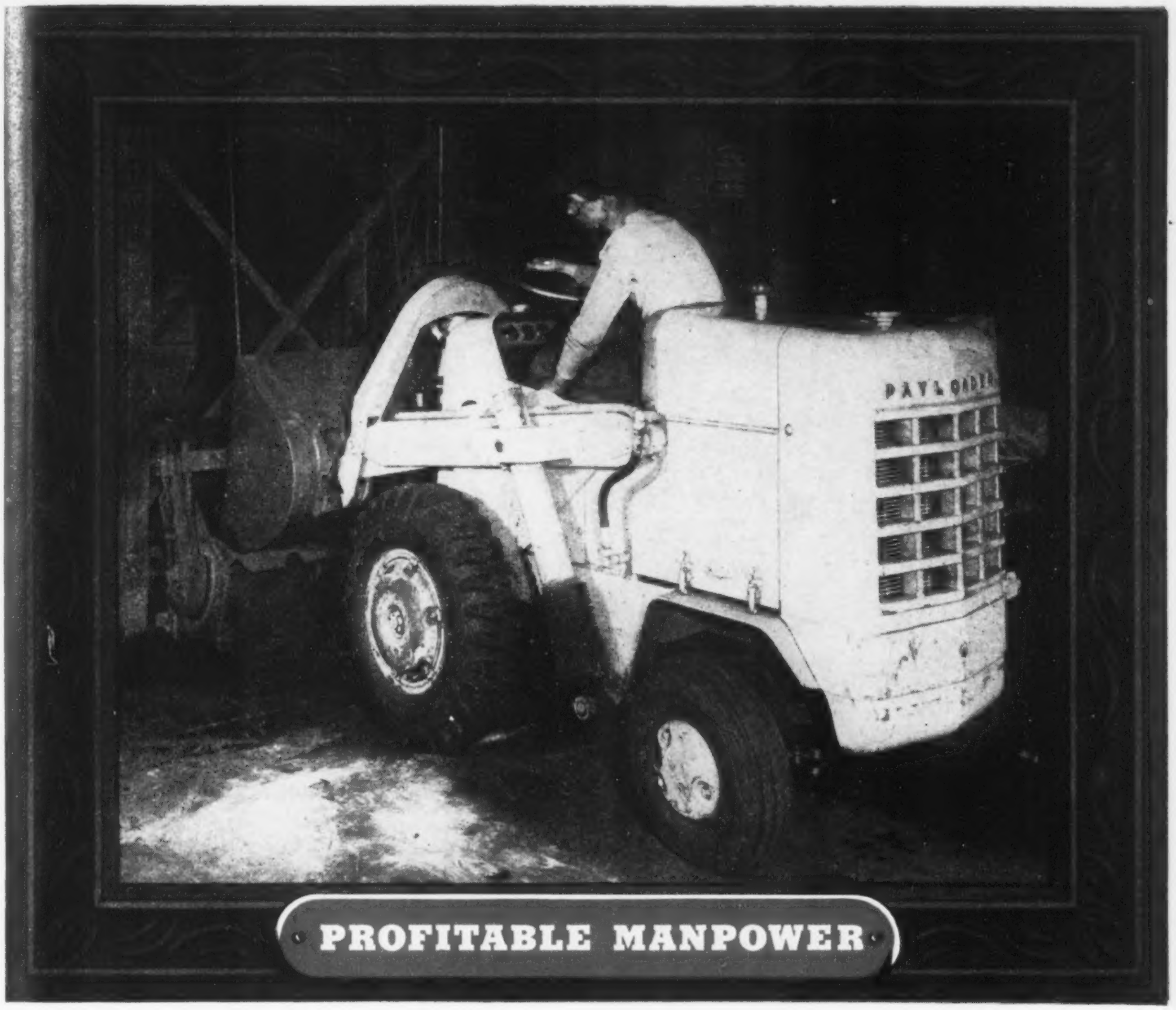
BUNKER HILL 99.99+% ZINC

Sales Office for Pacific Coast: **NORTHWEST LEAD CO., SEATTLE, WASH.**



This man may have been good with a wheelbarrow and hand shovel, but his production is several times greater as a "PAYLOADER" pilot. He's happier and so is his boss because they both make more money.

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"PAYLOADERS" are available in seven sizes, from 12 cu. ft. to 1½ cu. yd., to master your jobs both indoors and outdoors. Get full facts *now* on cost-cutting, time-saving, production-boosting "PAYLOADER." The Frank G. Hough Co., 733 Sunnyside Ave., Libertyville, Ill.

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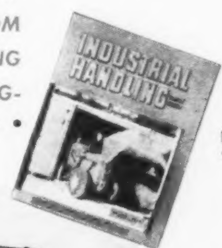

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CRANE-BRIDGE BRAKES
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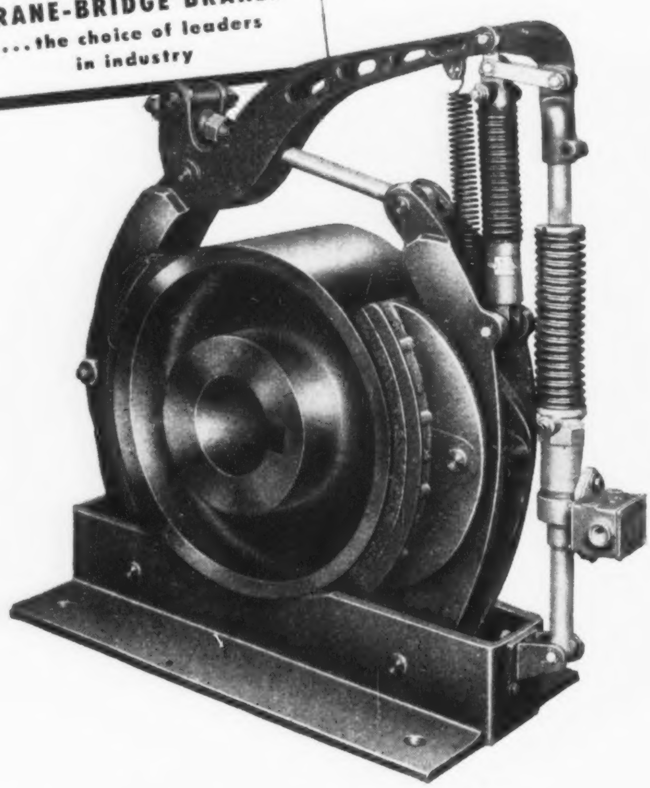


Your cranes are *safer* when equipped with Wagner CRANE-BRIDGE BRAKE SYSTEMS

Your operators have full control of cranes when Wagner *Hydraulic* Crane-Bridge Braking Systems are installed. They stop your crane the way you stop your car—simply—positively—safely. Wagner Hydraulic Brakes provide even the heaviest steel mill ladle cranes with controlled deceleration for smooth, precise stops.

NEW
Snap-Acting Switch assures complete dependability

Wagner Type HM-2 Crane-Bridge Brakes are equipped with a *positive* limit switch that is mechanically operated by the piston rod of the releasing cylinder. Switch is snap-acting —no slow make-or-break contacts.

Safe while operating...Safe while parked

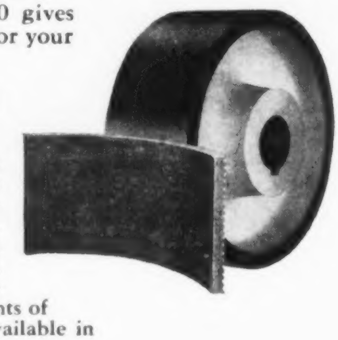
The new Wagner Type HM-2 Bridge Brake System provides operator-controlled hydraulic braking for service stops and spring-set braking for parking. The new limit switch positively holds the parking brake in released position, until it is set by the operator. The parking brake also sets automatically, to bring the crane to a gradual stop, in case of power failure. Limit switches can be used to automatically set the brake as the crane approaches the end of the runway.

The operator always knows when the parking brake is released because a signal light is illuminated only when the setting spring is fully compressed.

* * *

Only Wagner Hydraulic Braking Systems are equipped with the remote control bleeder that keeps the lines full of fluid and makes bleeding the system a simple "one-man one-minute" job, and only Wagner offers the self-centering device that prevents brake shoe drag by automatically assuring equal clearance of both shoes. Other features include one-point shoe adjustment, 200% emergency torque, and non-scoring molded lining blocks that are easily replaceable.

If your cranes are not equipped with Wagner Brakes, we can show how simple it is to install a modern hydraulic system. If you still have old-style Wagner Brakes, your system can be easily modernized with our complete conversion kits. Bulletin IU-40 gives full information—write for your copy.



Replacement Lining and Brake Wheels

Wagner offers the perfect combination of brake wheel and non-scoring lining for replacement needs. Wagner Brake Lining is specially designed and manufactured to meet the exacting service requirements of industrial braking. It is available in rolls, blocks, and discs.

® Wagner Electric Corporation EST. 1891

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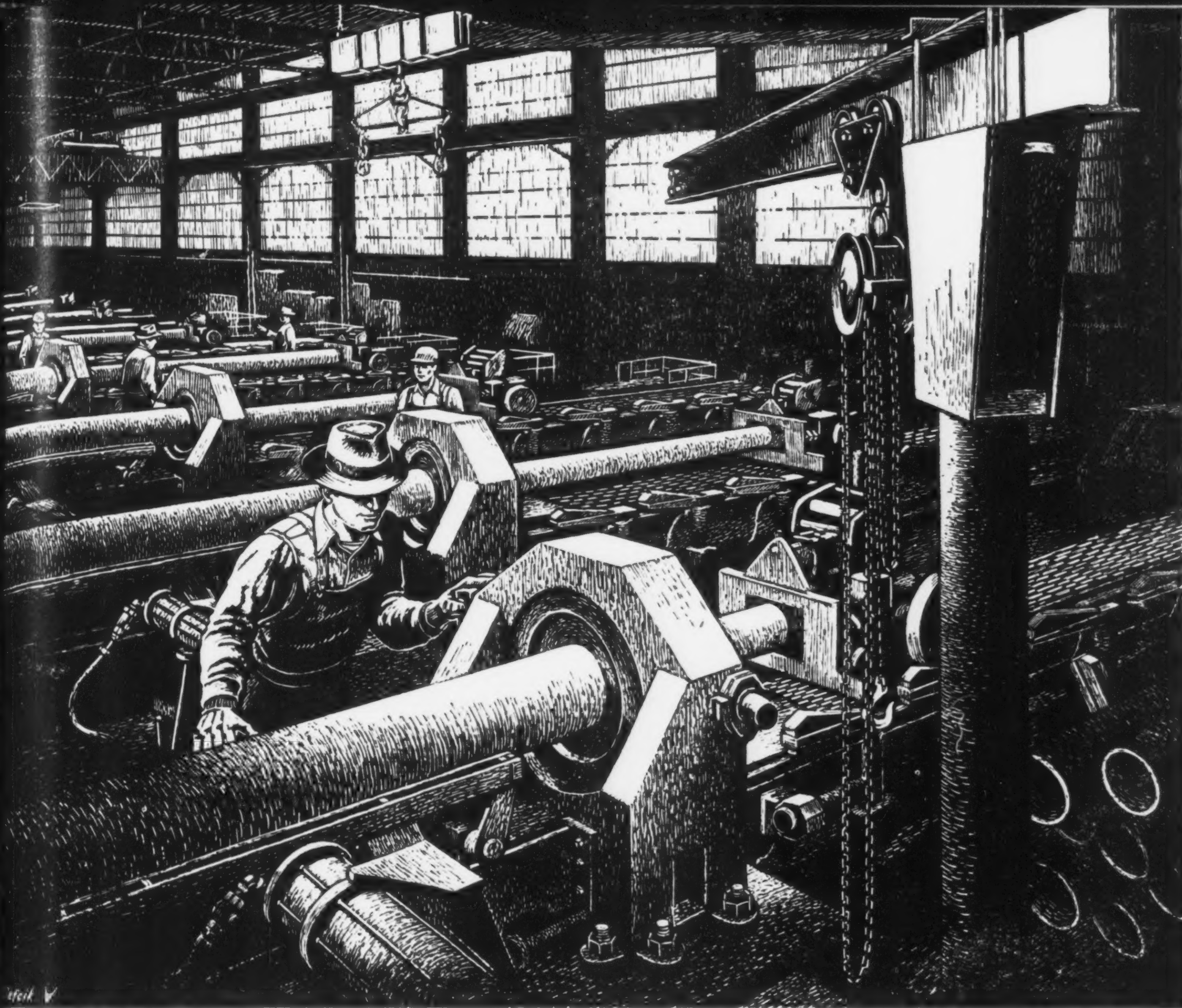
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

I52-2



Cold Drawn Mechanical Tubing — *Scratchboard Drawing for Pittsburgh Steel Company by A. B. Sefcik*

Progress in Steel . . . *Means More Special Tubing*

Cold drawn seamless tubing has long been a specialty at Pittsburgh Steel Company. Upon completion of its Program of Progress, which is increasing finished product capacity by 82% and ingot capacity by 50%, this high-quality product will become available in even greater quantities for many vital defense and civilian needs.

For example, the importance of Pittsburgh Mechanical Tubing to defense is demonstrated by the fact that it serves in such diversified ways as bushings for tank tracks, cylinders for aircraft hydraulic equipment — even as rocket launching tubes. Civilian uses include automobile drive shafts, pump plungers, and parts for farm equipment and machine tools, to name but a few.

Many manufacturers find that Pittsburgh Seamless Cold Drawn Mechanical Tubing has the uniform physical qualities, size accuracy, and fine surface finish that makes it easy to machine—saves production time, cuts costs, and improves product performance. Also important to defense and civilian needs are other Pittsburgh Steel tube specialties for power plants, boilers, condensers, and refinery stills.

The expanded output of these important products will be made possible by the extensive $60-million Program of Progress which is designed to round out the company's line of products better to serve its customers. They in turn will be able to accelerate their production of vital items necessary to speed our national defense program—at the same time maintain a high level of civilian economy.

Program of Progress

Acquisition of Thomas Steel Company	100% Complete
Installation of new 66-inch High Lift Blooming-Slabbing Mill	100% Complete
Increase of Blast Furnace Capacity by 12% Per Year	60% Complete
Increase of Open-Hearth Capacity by 50% Per Year	50% Complete
Installation of Continuous 66-inch Hot Rolled Sheet-Strip Mill	70% Complete
Installation of 66-inch Cold Rolled Sheet-Strip Mill	50% Complete

Pittsburgh Steel Company

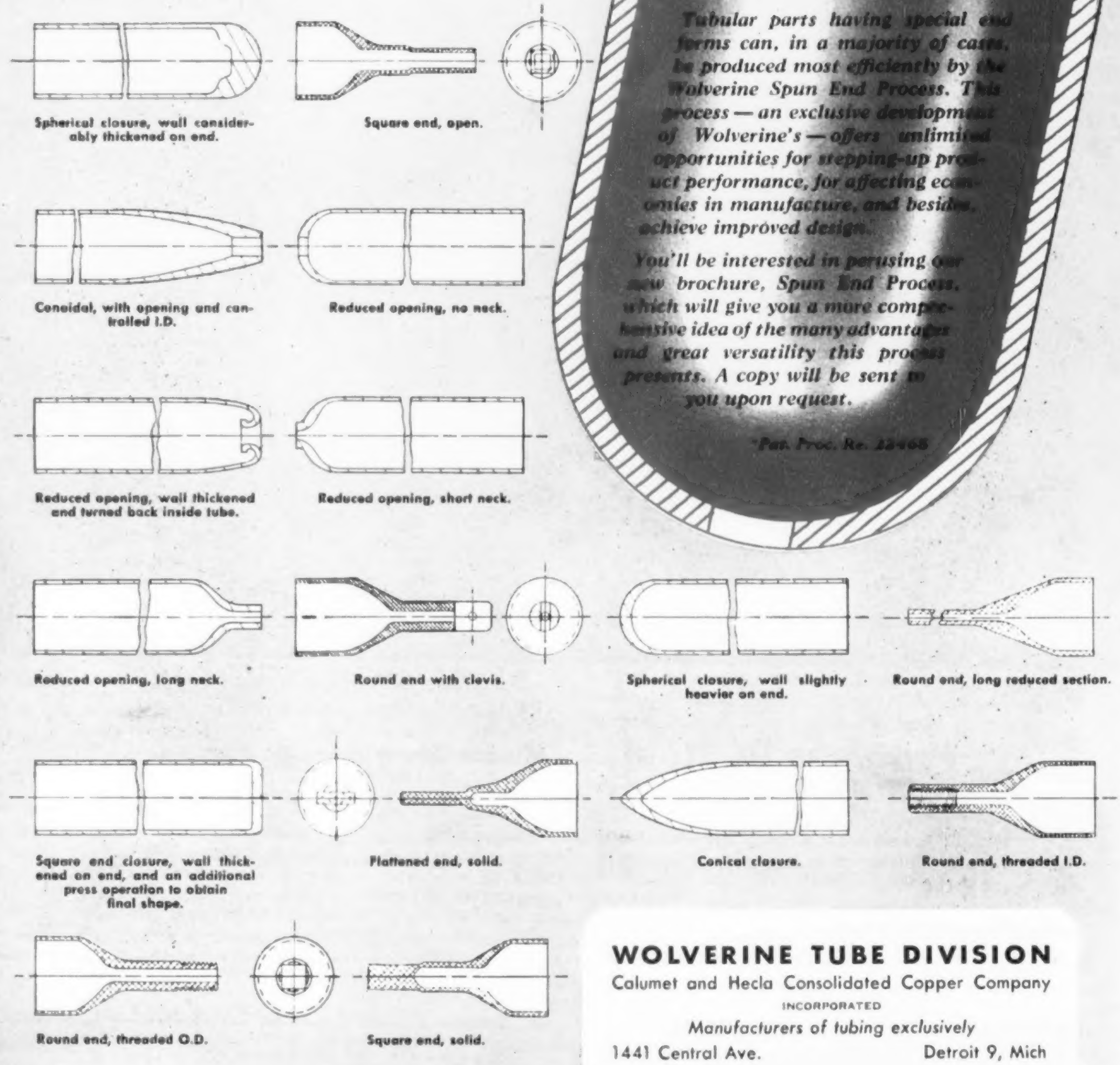
Pittsburgh, Pennsylvania

A wide range of end shapes are offered by our SPUN END PROCESS*

Tubular parts having special end forms can, in a majority of cases, be produced most efficiently by the Wolverine Spun End Process. This process — an exclusive development of Wolverine's — offers unlimited opportunities for stepping-up product performance, for affecting economies in manufacture, and besides, achieve improved design.

You'll be interested in perusing our new brochure, Spun End Process, which will give you a more comprehensive idea of the many advantages and great versatility this process presents. A copy will be sent to you upon request.

*Pat. Proc. Re. 22468



WOLVERINE TUBE DIVISION
Calumet and Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of tubing exclusively
1441 Central Ave. Detroit 9, Mich

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

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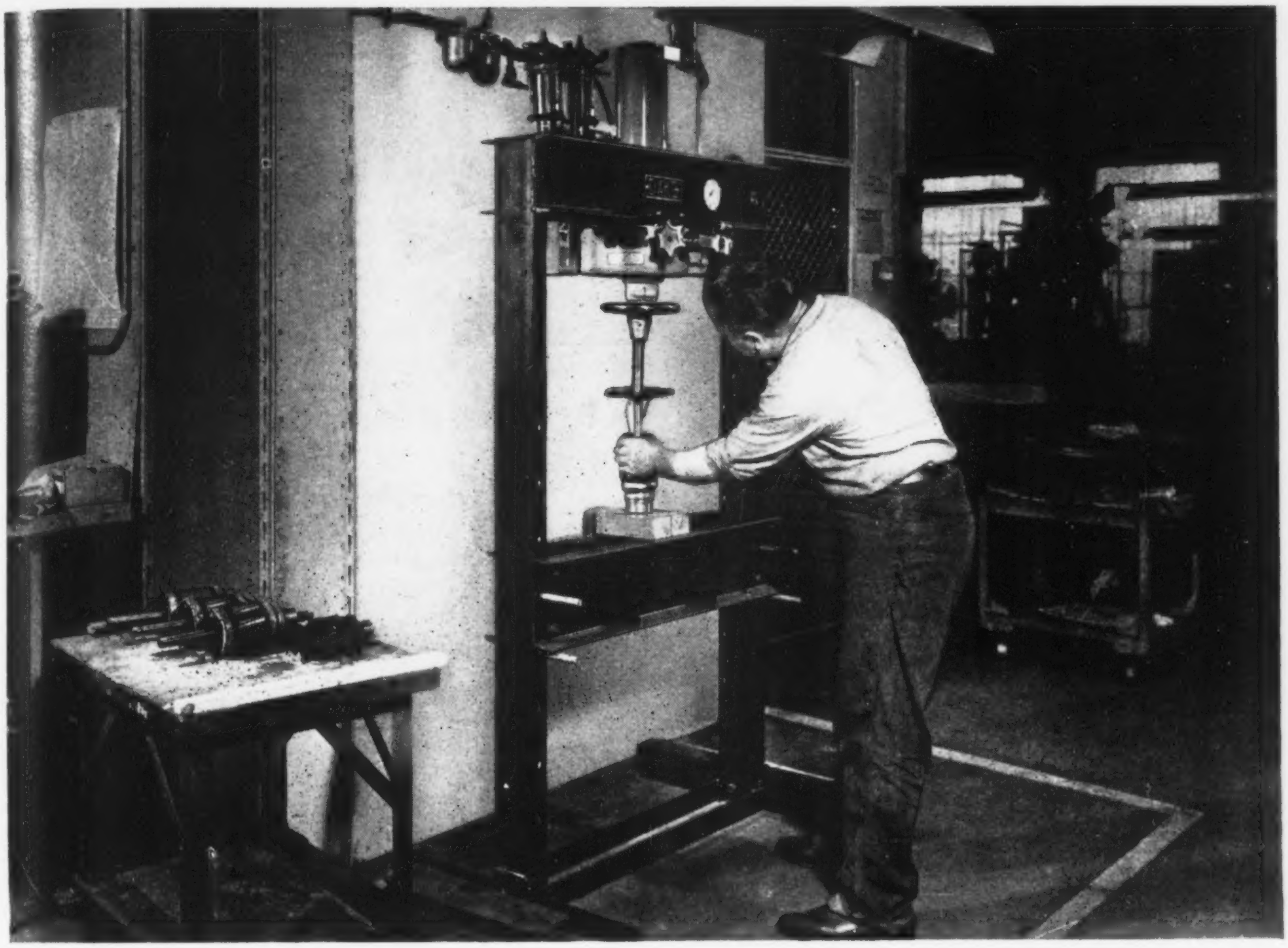


Motor Manufacturer Saves 15% on Labor Costs with Air-Powered DAKE Hydraulic Press

Here is another example of the way Dake Presses bring substantial production economies.

An electric motor manufacturer has a variety of forcing, forming, bending, and straightening jobs in his plant. These are a few of them:

Pressing fans on armature shafts (see photo above)

Pressing slip rings on armature shafts

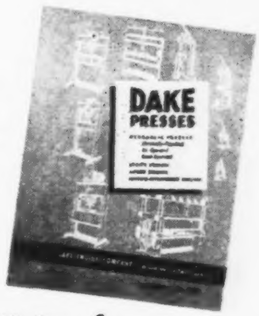
Pressing commutators on armature cores

Pressing laminations to thickness for stator frames

Pressing arches in stator frame coils

Until recently these jobs were handled in a variety of ways—mostly on a hand press. Since installing the Dake Air-Hydraulic Press he finds there is a saving of about 15% on labor costs. He also reports that the press affords a quicker, easier way to do many jobs that formerly were handled on other equipment.

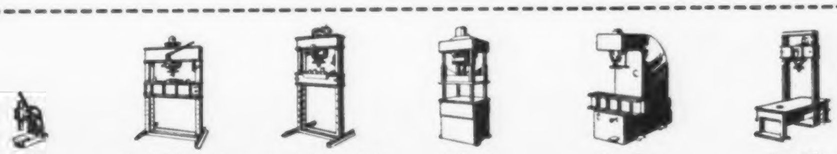
Dake Hydraulic Presses are available in hand, air, and electrically powered models with capacities from 25 to 300 tons. See your nearest Dake Industrial Distributor.



Write for this Catalog

Dake Engine Company, 602 Seventh St., Grand Haven, Mich.

DAKE PRESSES



Arbor Presses | Hand-Operated Hydraulic | Power-Operated Hydraulic | Guided Platen | Gap Type Presses | Movable Frame

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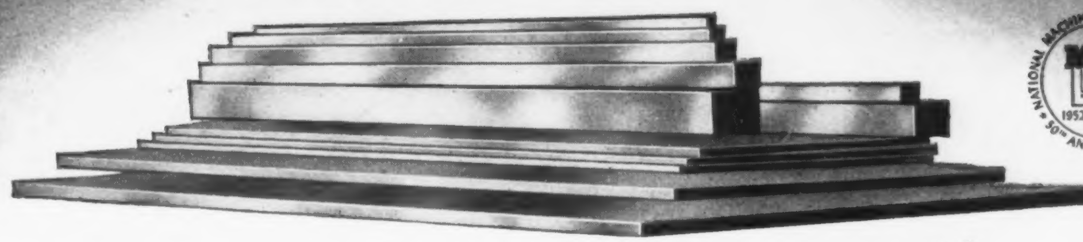
"Our railroad bridge is an
EYE OPENER
for anybody with an assembly problem"
"Whether you're assembling toasters or bridges," Ken went on, "it pays to set your sights on fasteners."
"Fasteners?" asked Jack.
"Right!" affirmed Ken. "We've saved plenty by taking the RB&W man's advice to switch from rivets to high strength RB&W bolts in assembling high stressed structural joints.
"These bolts stay tight and that saves us maintenance. They assemble faster, and that saves us labor and construction time."
There's a cost-cutting lesson for you in this story, whatever your industry.* So look to your fasteners for an often overlooked opportunity to reduce costs, and strengthen your competitive position. New inventions, like RB&W's SPIN-LOCK Screw, may prove more efficient than the fasteners you're now using.** Or you may save by the stepped-up production you get from using the finest fasteners... RB&W bolts, nuts, rivets and screws of uniform accuracy, dependability and physical properties.
Let RB&W help you make the most efficient use of fasteners on your assembly line. Address RB&W at Port Chester.
RB&W—The Complete Quality Line. Plants at: Port Chester, N.Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif. Additional sales offices: Philadelphia, Pittsburgh, Detroit, Chicago, Dallas, San Francisco. Sales agents: Portland, Seattle. Distributors from coast to coast.
RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY
*If you're interested in construction, write RB&W at Port Chester for the free article, "No More Riveting."
**New SPIN-LOCK Catalog is in the Product Design File. Write for extra copies.
RB&W
107 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG
M. Hook

GET UP TO 50% MORE PIECES

from punches and dies made with...

Starrett No. 497 AIR HARDENING PRECISION GROUND DIE STOCK



UP TO 50% MORE PIECES PER SHARPENING! That is what you'll get with punches and dies made from the new Starrett No. 497 *Air Hardening* Precision Ground Die Stock. 5% chromium content plus a special analysis to insure good hardening properties makes it highly wear resistant — ideal for long run production dies and punches and for stamping silicon, stainless steel, Monel and other abrasive materials. Also for thread roller dies, rolls, master hubs, precision tools, gages, large blanking dies, long punches, trimming dies, forming dies, coining dies, machine parts and other precision pieces.

New Starrett *Air Hardening* Die Stock is non-deforming ... no distortion, no cracking, no costly rejects, less finish grinding. It's fully spheroidized annealed for easy machining with a wide hardening range for foolproof heat treating. Order a supply today through your distributor. He'll give you prompt, dependable, quality service.

"JUST LAY IT OUT . . . AND SAW IT OUT"
For best results use Starrett Band Saws

NOW— 4 TYPES—295 SIZES

NO. 497 AIR HARDENING (Non-Deforming)
NO. 496 OIL HARDENING (Non-Deforming)
NO. 495 OIL OR WATER HARDENING
NO. 495 WATER HARDENING

Flat stock in 18" lengths, die stock in 36" lengths. Thicknesses from 1/64" to 3" — widths from 1/8" to 14". Each piece marked for size and type and packaged in protective envelope.

NEW FOLDER and WALL CHART lists all sizes plus formulas for air, oil and water hardening. Write for it. Address Dep't IA.

Starrett — STARRETT TOOLS — SINCE 1880 — WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

VISIT THE STARRETT EXHIBIT — BOOTH 1843 — National Metal Congress — Philadelphia, October 20-24

THE IRON AGE Newsfront

► Metal Show visitors will note some companies are well aware the customer is climbing back into the driver's seat. Advance indications are there will be more hard selling, more practical demonstrations than there have been at any Metal Show for the past dozen years.

► The first large sized coil of titanium strip made will be on exhibit at the Metal Show. The coil is 460 ft long, the strip 37 in. wide and made of RC 70 titanium. This is not a commercial product and was made for exhibition purposes only.

► Large cities may have stocks of new lower priced autos but the smaller towns and villages are sold out most of the time. The Southern market for used cars is active with agents continually showing up at Northern auctions of lower priced cars--especially 1949 and 1950 models. A good market for 1947 and 1948 models also prevails. Even though new cars are selling better than generally supposed, buyers continue price conscious.

► Submerged arcwelding is being used to repair crane wheels, kiln tires and various types of rolls and shafts. New flexible welding equipment, having an extension nozzle with a welding head, is being used for some repair jobs.

► At the Sept. 30th meeting of the U. S. Army Metallurgical Advisory Board on Titanium, one subject which received considerable attention was: "How can we expand the use of the metal?" Nobody came up with a good answer, primarily because metal costs are still too high to be competitive with other materials.

► Laboratory tests show that use of an oxidation inhibitor in transformer oil base stock gives an expected service life three to five times greater than conventional transformer oil.

► Machine tool industry will probably operate at a satisfactory overall rate until June 1953. After that it's anybody's guess unless Congress votes enough money to keep defense procurement levels up. Some think the best stimulant to keeping the industry healthy is reform of present laws on depreciation. There is some hope that various government agencies are coming around to this point of view.

► Farm purchasing power looms as a bigger and bigger factor in industry. Buying habits in family centers are no longer different from those in cities. Mortgage commitments are up. Sales of appliances, home furnishings, farm implements are good. Farmers are well heeled but look for quality and cost saving features in products offered.

► Fabricated structural steel inquiries are running well behind last year. One large fabricator reports a drop of 25 pct. Tip-off came recently when 28 companies submitted bids on a 200-ton job. Pickup is expected late this year.

► Interest in Great Lakes barge shipping is developing among barge shipping people. At least one concern is studying designs for a barge that could be handled on the Lakes, and if plans are acceptable, can be expected to approach the ICC on the matter in the near future. Barges would not vary greatly from conventional models but would be of heavier construction and have greater freeboard.

► Since 1947 it is estimated that production of 7 million ft of quenched and tempered oil well casing by a single large producer has saved 300,000 lb of molybdenum and nearly 1,500,000 lb of manganese. Formerly, such pipe was normalized and tempered--alloy additions furnished necessary hardenability.

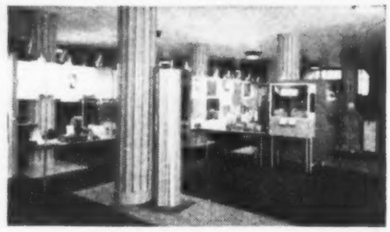
MINNEAPOLIS
Sept. 29, through Oct. 1.

MILWAUKEE
Oct. 7, through Oct. 10.

Coming to help you

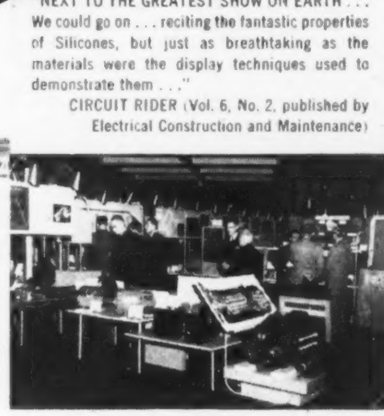
solve problems in design and production!

ST. LOUIS
Sept. 23, through Sept. 26.

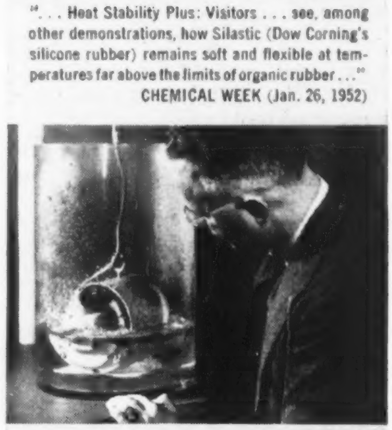


"BRINGING the mountain to Mohamet might best describe Dow Corning Corp.'s traveling exhibit . . . Free standing panels . . . separate the exhibit into nine bays, each emphasizing a property of silicones and showing where that property brings a benefit to an actual end product or operating unit . . ."
INDUSTRIAL MARKETING (June 1952)

"NEXT TO THE GREATEST SHOW ON EARTH . . . We could go on . . . reciting the fantastic properties of Silicones, but just as breathtaking as the materials were the display techniques used to demonstrate them . . ."
CIRCUIT RIDER (Vol. 6, No. 2, published by Electrical Construction and Maintenance)



". . . Heat Stability Plus: Visitors . . . see, among other demonstrations, how Silastic (Dow Corning's silicone rubber) remains soft and flexible at temperatures far above the limits of organic rubber . . ."
CHEMICAL WEEK (Jan. 26, 1952)



"IF YOU HAVEN'T already seen it, don't miss it when it comes around . . ."
POWER ENGINEERING (May 1952)

BUFFALO
Oct. 29, through Oct. 31.

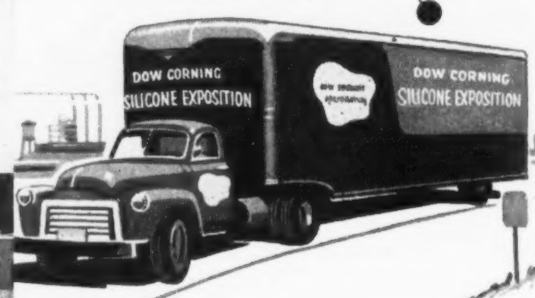
NEW HAVEN
Nov. 11, through Nov. 13.

BALTIMORE
Nov. 18, through Nov. 20.

NEWARK
Nov. 4, through Nov. 7.

CINCINNATI
Oct. 21, through Oct. 23.

WINSTON-SALEM
Dec. 9, through Dec. 11.



DOW CORNING SILICONES . . . are no longer a mystery or a "future possibility" to the 17,000 executives and engineers, representing more than 4600 plants, who have already seen the Dow Corning Silicone Exposition.*

They learned that silicones are fluids and resins that keep clothes and shoes and brick walls dry in the rain. They're fluids that polish without rubbing.

They're rubber that won't melt on hot aircraft engine cylinders or freeze on switches that operate bomb bay doors at 100° below zero.

They're electrical insulating resins and varnishes that double the power of electric motors, or multiply by 10 the life of electric machines.

They're paints that protect metal at 1000°F. They're foam killers and release agents. They're a whole family of new engineering materials that can help you to improve your product or to cut production costs.

*In Boston • Chicago • Cleveland • Dayton Detroit • Fort Worth • Houston Indianapolis • Los Angeles • New York Philadelphia • Pittsburgh • Seattle Washington, D.C. • or Wichita.

DON'T MISS IT

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Dow Corning Corporation, Dept. O-22
Midland, Michigan

Kindly include me among your guests at the private showing of the Dow Corning Silicone Exposition in

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CANADA: Fiberglas Canada Ltd., 1200 Bay St., Toronto, Ontari
ENGLAND: Midland Silicones Ltd., 49 Park Lane, London, W

STEEL: What Will the Industry's Future Be?

Experts expect evolution, not revolution . . . Future expansion will be well planned . . . Changes faster . . . Steel will be made faster, tougher, with less waste—*By W. V. Packard.*

What will the steel industry of tomorrow be like? Companies building or expanding great plants at costs of $300 or more per ton of capacity would like to know—for sure.

To protect their huge investment and make expansion as prudent as possible they are making exhaustive studies of future possibilities. In their studies they try to analyze future trends in markets, equipment, processes and expansion—even in other industries.

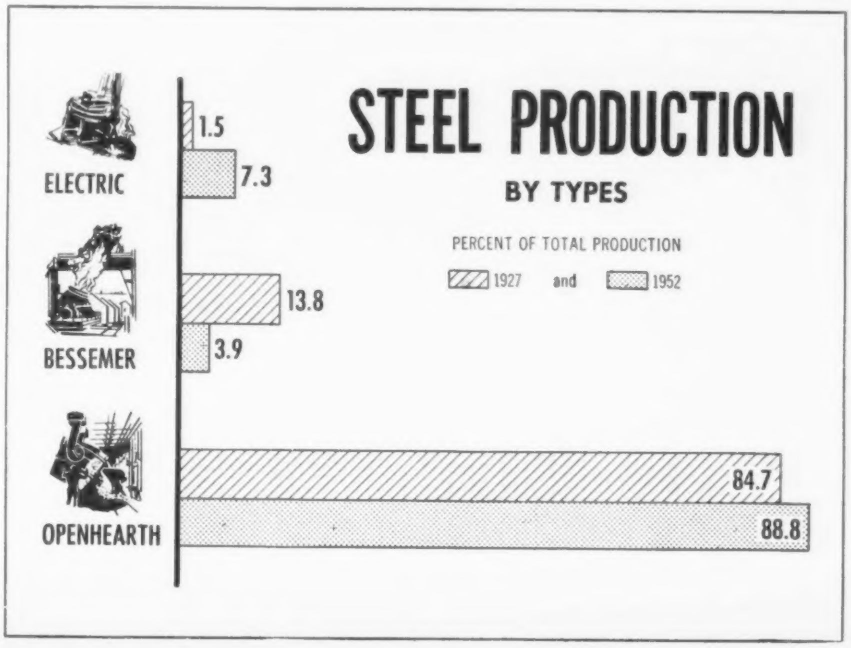
They admit that their growing commercial research is not an exact science—that, at best, their forecasts are educated guesses. Yet this is quite a forward step from even a few years ago when practically no professional talent was utilized in planning the future.

Steel of the Future — Putting some of their forecasts together, here is what steel of tomorrow might be like:

Steel of the future will cost more. But it will be tougher; it will do more work; and it will last longer. Production processes will be basically similar to present practice. But technological improvements will permit the metal to be melted and refined faster, under much closer metallurgical control. And there will be less waste. The engineer will help the metallurgist improve strength with new shapes and better design.

STEEL EXPANSION: 1900 TO 1975

Year	Capacity (million net tons)	Production (million net tons)	lb per person
1900	21.2	11.4	330
1910	39.4	29.2	633
1920	52.3	47.0	886
1930	73.0	45.6	741
1940	81.6	67.0	1015
1950	100.0	96.8	1263
1951	103.2	105.1	1362
1952	108.6	....	....
1953	115.6	....	....
1954	123.0	....	....
1975	150.0	....	....



Evolution, Not Revolution—But don't expect this to happen overnight. Great size, weight and investment in modern steel plants almost preclude sudden change. Revolutionary developments such as the continuous rolling mill come rarely in such heavy industry. When they do come, the change requires years, not months, to be completed.

Yet the years ahead will probably bring more and quicker changes than the ones behind brought. This is because the steel industry is no longer growing like Topsy; its expansion is being carefully planned. Location, area, plant layout, equipment, and materials handling decisions are all made with an eye to the future.

New plants and new firms will provide a receptive environment for steelmaking progress. The pilot plant has already become a standard proving ground for new processes in this as well as other industries. Biggest boost will come from firms that are convinced research pays off.

Taconite, direct reduction, turbo-hearth, continuous casting, hot and cold extrusion are words to watch. In the next 25 years one or more of these will probably shape the course of the steel industry more than the continuous rolling mill did during the last quarter century.

In projecting steel demand to 1975, the President's Materials Policy Commission arrived at a figure of 150 million net tons, of ingots and

steel for castings. Prior to the Korean conflict and the current huge expansion program, this would have sounded fantastic. Now hardly an eyebrow is being raised. Look at the expansion record since 1900, projected to 1975 (see table p. 193).

Iron Ore—Raw materials supplies will have to be expanded to keep pace with steel. Iron ore will come from three main sources: (1) High grade domestic reserves; (2) beneficiation of low grade reserves; and (3) imports.

Total domestic reserves of iron ore are estimated at some 80 billion gross tons. (Record consumption last year was a little more than one-tenth of one billion.) But only a fraction of this total is high grade.

Ore costs are bound to go up as mining goes deeper and expensive benefication plants are built. Such plants are now under construction and limited tonnage of beneficiated ore pellets is being produced. These plants will be completed at capital cost of perhaps $25 to $30 per ton. Within 5 years they will be producing 15-20 million tons of beneficiated ore. After that output could be expanded as demand warrants capital investment.

Low-grade ore deposits may one day be beneficiated and smelted locally in small electric furnaces or low shaft blast furnaces. Both processes produce high grade pig iron with a minimum of coke.

Imports of high grade ore (mostly from Canada and Venezuela) will expand at an equal if not faster rate than beneficiation. Rising costs of producing domestic ore will make them even more attractive. If beneficiation keeps domestic output from falling, imports will probably be able to fill the big gap of expanding consumption.

New Alloys—Coal reserves are adequate. But use of poorer quality material will require more and better facilities for preparation and blending. Limestone is plentiful. Fluorspar reserves are limited, will probably be augmented by deriving fluorine from phosphate rock. Such a process is now under development.

Most of our alloying metals must be imported. Future availability of them, to some extent beyond our control, will be an important factor in metallurgical practice. Conservation will be the keynote; better steels will be made with less strategic material. Use of rare earths will increase. And alloying combinations as yet untried will spring to the fore.

Several processes for direct reduction of iron have been employed to produce sponge, pellets or briquettes. Though these methods have been gaining stature in Europe, they are considered costly compared with domestic practice (further refining is necessary). Yet some variation may eventually be used to develop local deposits of U. S. ore.

Hard to Beat—The modern blast furnace still operates on the same principles as its early ancestors, though its size dwarfs them by comparison. Its efficiency has been greatly increased by washing, treating and blending coal and ores. Adoption of high pressure tops can increase efficiency by perhaps 15 pct, while using 10 pct less coke. Employment of natural gas may be used to further reduce coke consumption. Though other ore smelting methods may be adopted, this work horse of the industry will be with us for a long time, because it is highly efficient and is still being improved.

Nearly 90 pct of our steel is produced in openhearth furnaces. Electric furnace output is increasing and now accounts for about 7 pct. Bessemer converters, though popular in Europe, are declining in this country.

Short Cut—Continuous casting has a bright place in steel's fu-

Iron & Steel—1950 and 1975

Production, Consumption of Materials, Capacity
(million net tons)

	1950	1975
Production		
Crude products:		
Steel mills—ingots and steel for castings	96.8	150
Foundries—rough castings	23.0	35
Total crude products	119.8	185
Finished products:		
Steel mills—including steel castings	72.2	112
Foundries—finished iron castings	15.3	23
Total finished products	87.5	135
Consumption of Materials		
Home scrap	35.9	60
Purchased industrial scrap	10.9	15
Purchased obsolete scrap	22.0	32
Total scrap	68.8	107
Pig iron	65.0	100
Iron ore (assuming 50 percent recoverable iron)	130.0	200
Blast furnace and foundry coke	64.4	90
Limestone	33.5	50
Capacity		
Steel ingots	100.0	160
Blast furnaces	71.5	100
Byproduct coke ovens	72.5	100

Source—Report of President's Materials Policy Commission.

ture. Savings in scrap, equipment, and thus the cost of finished steel are possible. The process is particularly applicable to small operations. But it will not make ingot molds, stripping cranes, soaking pits and blooming and slabbing mills obsolete in large plants.

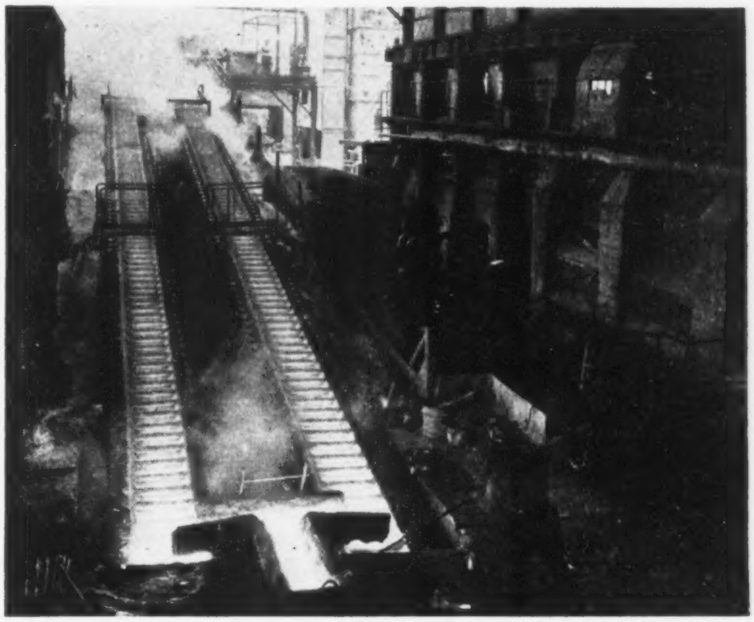
Extrusion Savings—Steel fabrication will be done quicker, cheaper and with less material by means of hot and cold extrusion. Both these processes, which use pressure to force the steel to flow into the desired shape, are being advanced rapidly. Only last week, Mullens Mfg. Co. reported its Koldflo process, heretofore limited to shell production, was being expanded on a commercial basis. It is also open to licensing.

Atomic Power—Development of atomic power will have a profound effect on the steel industry. Some processes now considered uneconomic or unfeasible may then loom quite attractive. The electric furnace—which has been gaining respect on its own right because it does so many things so well—may spurt into even more prominence.

Dream Plants — Small steel plants may one day grow—perhaps stimulated by protection of local freight umbrellas—in areas where no steel is now made. Such new plants would be among the first to use new developments (they usually have in the past).

They would use local or seaborne materials. And they might employ some combination of atomic power, electric smelting, direct reduction, turbo-hearth, oxygen, continuous casting, and hot and cold extrusion. Their location and product mix would be influenced by location and trends of their customers, just as the huge new Fairless works and expanding Sparrows Pt. plant are today.

Coastal locations will continue attractive as handy points of export, as well as accessibility to raw material imports.



PIG CASTING: Seventy ft will be added to this pig casting machine as part of Pittsburgh Coke & Chemical Co.'s $20 million expansion plan. Length will be 220 ft. It will have a capacity of 1600 tons per day.

Coke Oven Battery Starts

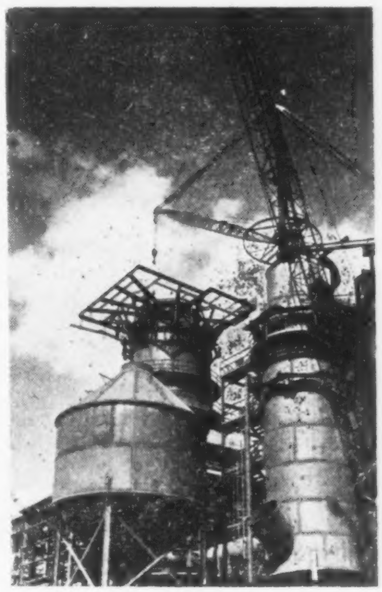
Pittsburgh Coke & Chemical Co. last week began getting the benefit from one unit of its $20 million expansion program at Neville Island, near Pittsburgh. Thirty-five new chemical-recovery coke ovens were put into full production, raising the number of ovens to 140 and increasing coke output by approximately one-third. Annual production previously was 600,000 tons of furnace coke, 75,000 tons of foundry coke. Cost of the new ovens was $6 million.

When completed, the expansion program will increase iron, coke, chemicals, and cement output of the plant. Company hopes to realize production from its new $8 million blast furnace before December. This will add 300,000 net tons of iron to present output from one other furnace now producing 470,000.

Approximately $3.3 million is being spent on four new chemical plants. This is in addition to more than $7 million spent on chemical expansion in the last 4 years. Cement production, now at an annual rate of 1.5 million bbl, will be increased 20 pct. Boiler plant capacity also is being expanded.

Since end of World War II, the company has committed $34 million to expansion.

Pittsburgh Coke & Chemical is the only major producer of merchant pig iron in the Pittsburgh area.



MORE IRON: New $8 million blast furnace (background) at Pittsburgh Coke's Neville Island plant will raise iron output by 300,000 tons per year.

STRUCTURALS: Won't Ease Yet

Demand running high . . . Allocations carry 2 months into next quarter . . . Quote 9-month delivery on fabricated steel . . . First quarter quotas limit new starts—By *R. L. Hatschek.*

The tight steel supply is generally expected to start loosening in the first quarter of 1953. This will not be true of structurals and heavy plate used in construction, according to suppliers and fabricators contacted by THE IRON AGE.

Only the most optimistic feel that these could begin easing in the second quarter and some believe the tightness will continue until near the end of 1953. This picture might change if the railroad carbuilding program were to bog down further, but there haven't been any signs pointing to that.

Demand for structural steel remains heavy with consumers pressing for delivery. The 2-month production loss in this market really hurt. Some people were apparently misled by heavy mill shipments immediately after the strike's end, losing sight of the 2 months' lost output.

Despite the decline in quarterly allocations, actual deliveries of structurals may increase in some cases. This is explained by the fact that the strike caused delays in shipments of earlier allocated material. The delayed rated orders carry over into the following quarter.

Get in Line—This has resulted in a 2-month carryover from one quarter to the next. Rated orders were doubled up in October and November and fourth quarter CMP tickets will be good for January and February. If you have the right priority and can get first quarter allocations of structural steel it still won't be rolled until March.

Mill will then deliver to the fabricator in April and fabrication will take another 2 months. That adds up to 9-month delivery if you get busy now. Some of the smaller fabricators are reported to be quoting shorter delivery time in order to get the few inquiries now coming out in some districts. The trade generally figures the only way this could be accomplished would be by reshuffling orders and steel on hand.

Fabricators in those areas where new inquiries are light are not unhappy about it. It gives them a little more time to catch up on outstanding orders. But the turn of the year is expected to bring a whole rash of new highway jobs in the East. Ohio Turnpike, extensions of the New Jersey and Pennsylvania Turnpikes, the Garden State Parkway (New Jersey) and the Schuylkill Expressway (eastern Pennsylvania) are some of the super highways that are just out or will be coming out at the beginning of the new year. And they'll take a lot of structurals and plate.

Construction Awards, Inquiries on P. 207

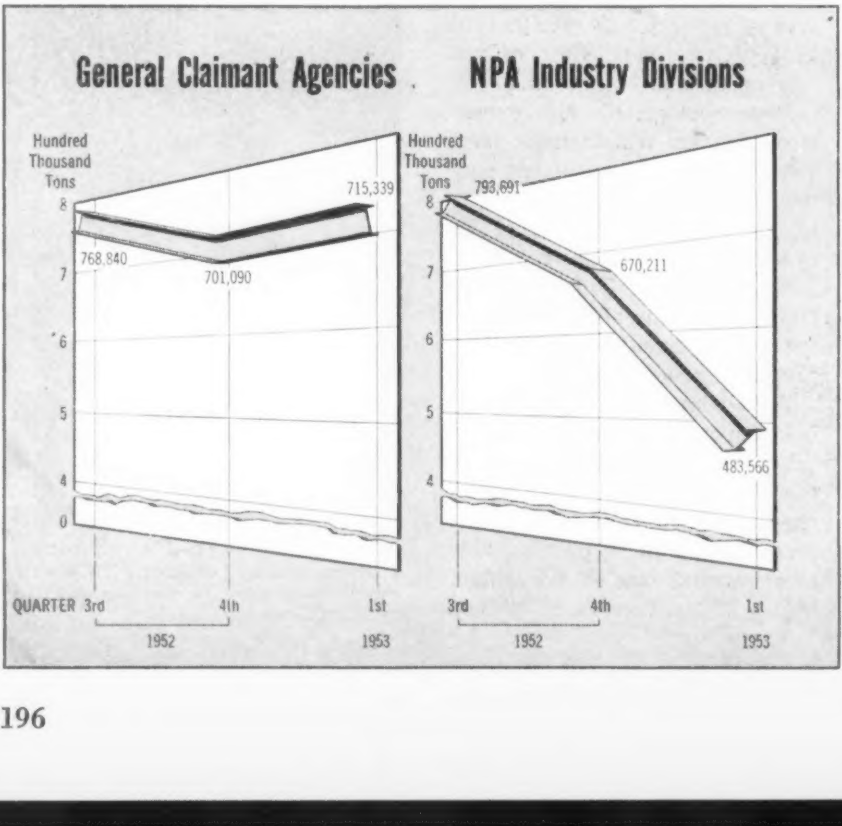
As a result of tightness, many buildings are now being designed for reinforced concrete construction. This is particularly true of new school projects.

Starts Limited — Following its usual allotment pattern, Defense Production Authority has assured Atomic Energy Commission and the military of meeting all requirements in the first quarter. With a few exceptions, all other structural steel allotments are limited to advance first quarter allocations. Quotas total 1,317,096 tons against an estimated supply of 1,415,000 tons.

This means that limited construction can continue on projects already started. But new starts will be limited to industrial expansion, commercial and municipal projects directly essential to the defense program.

Defense Dept. will get the biggest ration (185,000 tons compared to 173,000 tons in the fourth quarter). AEC, Civil Aeronautics Administration, Defense Materials Procurement Agency, and Bureau of Public Roads were the only other general claimant agencies to get boosted quotas. None of the National Production Authority industry divisions were increased.

Allocations of Structural Steel



INDUSTRY: How to Move Back to Farm

What management can expect when moving to rural site . . . What it must consider . . . Towns want industry . . . Firms should hire local workers, gain good will—*By J. B. Delaney.*

What happens when industry moves into a rural or semi-rural community? Management of many companies contemplating decentralization are asking that question. The answers are encouraging.

Initial reception will be good. So say companies who have been through the experience. Whether community attitudes stay that way depends on avoidance of pitfalls that might lead to trouble.

Most communities are anxious to attract industry. In fact local boosters are sometimes oversold on the advantages of their community.

Take the town that offered a 200-acre site with a good-sized, deep gravel pit smack in the middle of it to a large electrical equipment manufacturer. The company just couldn't figure how to build a plant in the shape of a railroad round-house.

Check for Overcharge—A well-known company also has had this experience: The community thought the firm had been overcharged by the owner of the site. Townsfolk raised a fund equal to what they considered the overcharge and presented a check to the plant manager. The company returned the check, but "gratefully retained the good will which the check symbolized."

Once the plant is built and ready to operate, the industrial newcomer has these problems to consider:

(1) Supervisory Jobs—One company with a successful history of getting along with its neighbors has established a firm policy of importing only enough supervisors to get the plant underway. After that, these jobs are given to local people who qualify. This often requires a period of company-sponsored training of promising candidates.

Using local people for the better jobs is good preventive medicine against gossip that outsiders are running the plant.

(2) Selecting Plant Manager—This man must be as good at public relations as he is at managing. He and his supervisors must become part of community life and should be looked up to as community leaders.

They must give forthright answers concerning the company, its employees, and its operations. They must work with school, church, and community leaders on mutual problems.

One company joined with business and civic leaders of a Pennsylvania town to solve a problem of inadequate hotel facilities. A corporation was formed and a hotel was built. The company turned over most of its stock in the hotel to a local hospital, retaining only enough to make sure its customers and visitors could get a hotel room.

(3) Training Workers—Often skilled workers are not readily available despite an overall adequate supply of labor. This problem is solved with training programs. Some craftsmen who have moved from a community to another offering more opportunities lose no time returning to the home town once jobs are available.

Companies have found that farm workers and women quickly become adjusted to work in industry. They make good workers, are steadier on the whole than workers in strictly industrial communities. They are readily trained. A safety supervisor of one company finds that people unaccustomed to industrial work often adjust to an operation better than some old-time industrial workers.

Locating in a small community generally offers no advantage from the standpoint of wage rates. The experience of a large manufacturer is that "you can't run away from high labor rates."

Basic Needs—Not every community will have all of the advantages listed in the accompanying box. But lack of one or more basic needs would be the signal to go slow. Often a preliminary investigation will be encouraging, but a further check will uncover something to rule out a site under consideration.

On a re-check of what apparently was a good site, one company's field team was bowled over by a large sign in a hotel lobby reading, "Water shortage! Waste not, want not!". Careful inquiry revealed a questionable water supply. The site was dropped.

Sometimes intangible considerations will be a deciding factor in selecting a plant site. Before settling on a location for a new plant, a manufacturer decided to take a poll of engineers who would be asked to move to a new community. The engineers were asked

Checklist on Site Advantages

Selection of a plant site involves many considerations and a great deal of care. Points to watch before moving or building include:

(1) Labor supply
(2) Labor rates
(3) Transportation facilities
(4) Housing
(5) Schools
(6) Churches
(7) Shopping facilities
(8) Community and county debt and tax structure
(9) Water, gas, and sewage facilities
(10) Availability of vocational schools for training programs
(11) Community plans for attracting industry
(12) Does the community want you as a neighbor

whether they would prefer to live in a rural area, a metropolitan area, or the suburbs of a metropolitan area. About 80 pct preferred living in a rural community adjacent to a metropolitan area. One site under consideration suited this preference admirably.

Manufacturers also find that in moving people from one location to another they must offer the employee a better job to offset the usual problem of adjusting to a new community, new friends, new schools for children.

Time's Ripe for Expansion

Industry leaders are finding that the time is still opportune for expansion and are transforming their new plant blueprints into actuality. Management sank more money into expansion during the third quarter this year than in any other quarter in history. This was in the face of restrictions and shortages.

Dollar volume for the quarter amounted to $9.3 billion, bringing the total for the first 9 months of 1952 to more than $24.2 billion. There are solid indications that industry will spend $32 billion this year in new construction. This was the amount forecast before the steel strike. But steel strike or not, industry still pushes for that goal.

Executives in charge of construction are watching Defense Production Administration for clues as to the future availability of structurals. DPA has announced that enough will be available in the first quarter 1953 to permit work to continue on started projects.

"I like the attitude of that new man."

AUTOS: Producers Vie in Man Hunt

Wonder where next assembly line worker is coming from in a tight labor market . . . Signs point to long-term scarcity . . . Detroit, outside auto centers stricken—*By R. D. Raddant.*

Automobile producers are nervously sweating over the problem of where their next assembly line hand is coming from. If they are not actually facing a shortage in manpower, then, at least, automakers are engaged in an intensely competitive hunt for workers.

A plant in a small outstate Michigan city closed suddenly last week. The very next day personnel men from three large corporations were in town trying to recruit as many as possible of the 300 newly unemployed.

Meanwhile, one major auto manufacturer scrapped plans for a second shift and settled for a 9-hour day. Reason: Its employment office was unable to come up with enough workers.

A large help-wanted ad in a Detroit newspaper announced that 2000 jobs were open at another auto plant. Other ads held out overtime and other "bait" to workmen.

Long or Short?—These are not isolated incidents. They are repeated every day in the auto industry and related branches.

Optimists predict the labor market will balance when new model production levels off and the rush to catch up with steel strike production losses is over.

Yet, other signs point to a continuing labor shortage if good business prevails and defense cutbacks and controls don't bite deeply into defense and civilian production of the automotive industry.

No Reserve—Manpower in the Detroit metropolitan area is virtually exhausted. An even greater scarcity of available labor exists in outstate areas such as Flint, Saginaw and Pontiac. These smaller cities are major automotive producers but do not have a metropolitan population for a reserve labor pool. The Michigan Employment Security Commission had 20,000 job placements available during September alone.

Also, many defense plants that were under construction by automotive companies in these areas are now nearing completion. It is a matter of growing concern to employment experts how these jobs can be filled.

To complicate matters, old sources of manpower have been tapped repeatedly by automotive recruiters and are now practically non-existent. The South and Southwest, formerly drawn on heavily for assembly line workers, now have labor markets of their own. The tremendous industrial development in World War II and subsequent years in the South has nearly wiped out labor surpluses.

The Army Calls—Thousands of new workers are being lost to the draft each month. Young men of draft age with little or no working experience have long been the backbone of automotive assembly lines.

With nearly all auto companies now facing a manpower shortage, where will the solution be found?

"This is an engineer's dream, sir, think of the deep satisfaction you will have when you grind the valves, rebore the cylinders, and shape new sleeves and rods to your own specifications."

The best immediate answer probably lies in letting down the bars to potential workers now made ineligible for certain jobs by strict requirements. These barriers may be age, sex, or physical requirements such as size and weight. Auto plants will have to utilize available manpower even if it doesn't meet ideal standards.

Women probably furnish the largest available pool of potential workers. At mid-September there were 75,000 listed on Michigan jobless roles. A large number of these were women who could be used in industry.

Skirting Obstacles — One auto plant is already reviving plans, a World War II program, to hire and train girls for jobs usually filled by men. At the moment this seems to be the exception to the rule.

Another firm has hired men over 65 who were retired from other companies. In general, older men rehired are in the skilled group.

Meanwhile, automotive employment is growing in leaps. Chrysler Corp. had a total salaried and hourly employment of 111,076 in June. Now it is 120,095 and all Chrysler automotive and defense plants are hiring every day. Other companies are doing the same.

Coal Wage Hike Up to WSB

Wage Stabilization Board has scheduled a meeting with coal operators tomorrow, Oct. 10. Purpose is to weigh the facts of the coal settlement, — in other words, find a way to approve the pact which has boosted the basic mining wage more than can be automatically approved under present stabilization regulations.

Increased contribution to welfare fund will not be considered. But Washington talk is that increased productivity by miners—estimated all the way up to 29 pct since 1949—may be used as the way out. Decision must be made early next week if new pay, effective Oct. 1, is to show up in the Oct. 15 paycheck.

ALUMINUM: Set Third Round Goal

DPA wants 200,000-ton-per-year expansion . . . Would boost U. S. capacity to 1,746,000 tons . . . Revised stockpile target is the reason . . . Seek new producers—*By A. K. Rannells.*

Ending long speculation, the government said last week it was ready to back a third round of aluminum expansion—this time to the extent of an additional 200,000 tons of new capacity.

No government financial aid is planned except as a last resort. But Defense Production Administration is prepared to deal generously in the way of certificates of necessity and fast tax write-offs.

Bowing to the thinking of other government agencies (and some members of Congress), first chance at building the additional facilities will be extended to firms not now in the aluminum business. But they will have to make up their minds and act quickly.

"We propose to issue an invitation to American business firms to send in firm proposals immediately if they wish to participate in this expansion" mobilization director Henry H. Fowler told the Senate-House committee on defense production.

"This committee (has) urged that any additional supply of aluminum capacity found necessary should be obtained from non-integrated domestic producers. DPA will attempt to secure this (new) expansion from new producers—so far as possible."

Is It Needed?—Debate has been raging for several months as to whether more white metal capacity is necessary. Up until now, the target has been a domestic capacity of 1,546,000 short tons of primary aluminum. This figure is double the 1950 output of 719,000 tons.

This estimated production, plus about 550,000 tons of imports and secondary supplies from scrap, would put the available supply at more than 2,100,000 tons. Would this be enough?

Officials at DPA have never thought so and have constantly talked of more capacity. This opinion was held by former administrator Manly Fleischmann and was shared by his aide and successor, Henry Fowler, now director of Mobilization.

Lost Output—Meanwhile, shortages began to show up as a result of failure of the water supply in the Northwest and South. Aluminum Co. of America alone may lose 4000 tons output in the South during October while the loss in the Northwest is estimated at 7500 tons.

It is safe to say, says DPA, that should the water shortage continue through the whole last quarter, lost production for the last 4 months of the year could go to 60,000 tons.

Also, in late July the Munitions Board raised its goal for proposed acquisition for the national stockpile—and so advised DPA. The new stockpile figure, according to Mr. Fowler, has been revised upward.

Hence the decision by DPA, after "thorough and careful" study and "frequent consultations" with other government agencies, including the joint committees staff.

"The huge expansion which would have to be undertaken after the outbreak of a war would impose an almost impossible burden," according to deputy DPA administrator Sam Anderson.

Total Supply—With the additional 200,000 tons for which the DPA is setting its sights, completion would bring total domestic capacity to 1,746,000 tons by Jan. 1, 1955. Estimated imports, largely from Canada, and recovery from scrap would bring the estimated available supply to something like 2,375,000 tons.

Officials at DPA-NPA haven't figured out yet just what they will do to get the 200,000 tons in new capacity if they can't get enough firms outside the "big three" interested.

"We have had a number of firms coming in to talk over such action," one official said. "We feel sure that they will now come in with firm propositions that we can consider."

Even with the decision to add more capacity now, DPA is not satisfied that all requirements could be met in the event of an all-out war. But, officials say, capacity deficit would at least have been reduced to manageable proportions.

Commercial Cold Extrusion

Cold extrusion of commercial steel items up to 30 in. in length and weighing 50 lb will start soon under "Koldflo" process in new Mullins Manufacturing Corp. plant at Warren, Ohio.

Proposed addition will include 20,000 sq ft of floor space for bonderizing, pickling, annealing and sawing facilities. Firm will also add four 3000-ton presses to the two 2000-ton units which have turned out 1 million artillery and mortar shells.

Mullins already has sizeable order for truck and heavy vehicle parts and is negotiating others. Efficient, economical mass production techniques can be applied to cylindrical, precision smooth surfaces without use of alloy steels and with minimum machining.

Engineering experiments also show process effective in production of flanged, square, hexagonal or fluted shapes.

Hold Off Planes, Make Autos

Automobiles will be the sole product line, initially, at a General Motors' assembly plant being built at Arlington, Tex., with basic facilities for both auto and aircraft manufacture.

The Navy, which is committed to furnish special tools for aircraft production at the GM-financed plant, originally had planned that a "substantial" number of planes designed by Grumman would be built there. A change in Navy requirements has caused deferment of plane production at Arlington

First A-Gun Carriage Off the Line

Atomic warfare moved into the field at Aberdeen proving grounds last July 18 when Dravo Corp. of Pittsburgh shipped the first carriage for the Army's new atomic field artillery piece.

Shipment of parts for the superweapon left Pittsburgh less than 10 months after the formal contract was awarded Sept. 17, 1951. Barrel and breech for the piece, which fires atomic and high explosive shells, were produced at Watertown Arsenal, Watertown, Mass.

Dravo began fabrication of steel plate late last November after a materials procurement program had been set up. Production men first had to process hundreds of blueprints and shop orders for welding, machining and assembly. Establishing operational sequences for assembly and sub-assembly was another stumper. Problem of saving pounds for transportation facility while building recoil strength also kept Ordnance designers and fabricators busy. In addition to a number of lightweight metals, high tensile, carbon, alloy and stainless steels were used.

Assembly Line—Before production Dravo developed special jigs, fixtures to put the operation on an assembly line basis. Sub-assemblies of component parts were then set up in preparation for top carriage assembly. Close tolerances on the sub-assembly line kept workers down to 1/32 of an in.

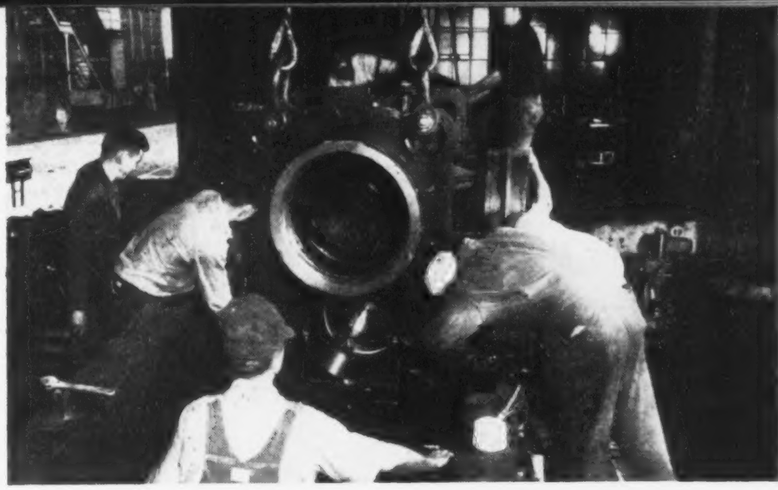
Carriage is 38½ ft long; made up of two double-web girders joined by transverse steel frames. Stainless steel flanges are fixed to the bottom of the girders. Steel castings are welded inside for bearings and gears.

Welding plays a major role in carriage fabrication. Total of 8200 ft is required in one assembly. Each weld is inspected by either Magnaflux Machine or dye penetration process before and after pieces are stress relieved.

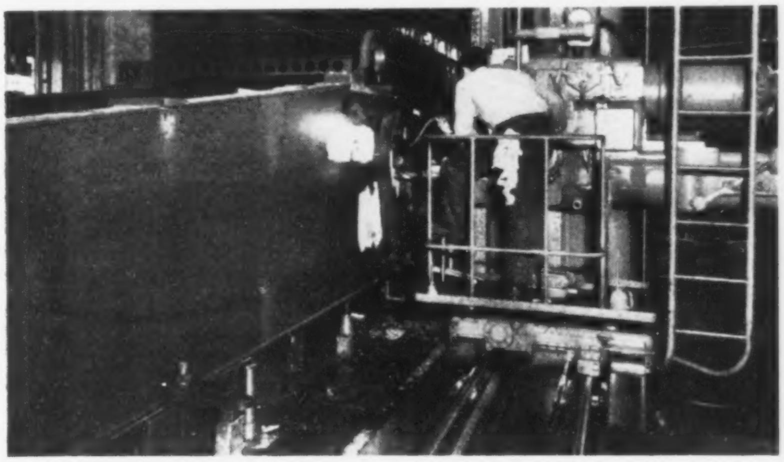
In final welding stages the carriage is rotated 11 times to lessen distortion.

Stainless steel slides were machined on a 26 ft planing machine rigged with a special support fixture. Another fixture was developed to support the cradle tube assembly for planing operations. Cradle tube, a heavy alloy steel casting, was pre-heated and maintained at 700°F before welding to top carriage.

Machining of the rack slide which guides sideways movement of carriage also called for a special fixture to keep cuts on the specified radius. When fabricating operation is completed at Dravo, Ordnance and company inspectors subject the carriages to rigid testing.



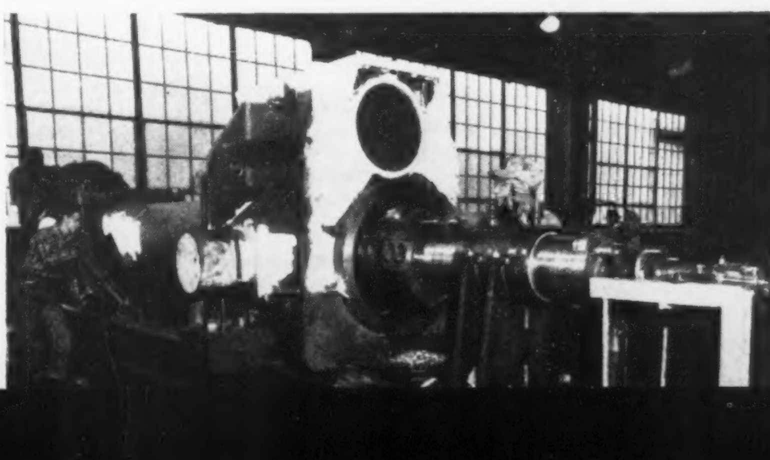
ASSEMBLY: Dravo workmen assemble cradle for atomic artillery piece.



BORING: Gear housings for top carriage are bored on a G & L mill.

MACHINING: A 26-ft planer machines pads and tracks on top carriage.

CONVERSION: Tube assembly was first bored on converted engine lathe.



—Raw Materials—

STEEL: Warehouse

Inventories average 40 pct. of normal . . . Little relief seen until first quarter.

Steel warehouses haven't shown any sure signs of recovering from the poke in the eye administered during the steel strike. Current inventories are estimated at 40 pct of normal—still at the lowest ebb of the entire defense period.

Even worse is the imbalance of inventories. The 40 pct estimate is on a tonnage basis and does not reflect lack of variety.

Prospects of a return to normal are not good just yet. Most warehousemen do not expect inventories to show much improvement until the first quarter of '53, and hope for a return to near normal by end of the second quarter.

Not Adequate — Following a warehouse tour arranged by New York Chapter of the American Steel Warehouse Assn., L. B. Worthington, president, U. S. Steel Supply Div., told newsmen last week, "Steel currently reaching warehouses from producing mills is being readily absorbed by consumers and in most sections of the

NEW PROCESS: For the past year a new proce[...] installed at the Uravan, Colo., mill of U. [...] its capacity. The process, just placed in operatio[...] uranium and vanadium from local ores, clai[...]

Supply Short

country the supply is far from adequate to meet demands."

He cited the shortage of large diameter hot-rolled and cold-finished bars and structural shapes and plates as being "particularly severe." Empty steel racks at the Peter A. Frasse & Co. warehouse, Lyndhurst, N. J., and the U. S. Steel Supply Div. building, Newark, the two warehouses inspected during the press tour, substantiated this statement.

Important Outlet—Vital role of warehouses as the steel industry's "retail" outlets is stressed by figures released by American Iron & Steel Institute. Of the 737 million tons of finished steel shipped by steel companies from 1940 through 1951, the largest portion went to warehouses (19 pct in 1951).

Shipments to warehouses during the 12-year period amounted to more than 115 million tons or 16.3 pct of the total. Construction and contractor's products accounted for 14.5 pct of the shipments. Automotive industry was the next largest consumer, receiving 13.8 pct of the shipments.

ew proce... treating high-lime uranium ores was being ... of U. S... dium Co. Now the Uravan mill has doubled ... operatio... lieved the most efficient for recovery of ...res, claim... company.

PROFITS: Industry Asks OPS to Help

Manufacturers have streamed to Washington for help in beefing up sad profits picture . . . Pass-through of metal costs forgets labor, freight . . . OPS is stubborn—*By R. M. Stroupe.*

That continued knocking at the door of Office of Price Stabilization is the sound of irate manufacturers who find nothing in the agency's towering stack of regulations that will guarantee a return to earnings health.

Palliatives offered piecemeal by the agency, in such forms as a "streamlined" application of the earnings standard procedure or a general overriding regulation, are not what industry wants as a cure for a weakened profits position. Pass-through of higher costs for a few basic metals is by no means a solution.

"We Want Relief" — In recent weeks industry representatives have streamed into Washington for conferences with OPS officials, hoping to make plain their conviction that only a price increase compensating for greater costs of labor, inbound freight, fuel, and materials other than steel, copper, and aluminum can insure fair profits.

One example was the presentation by men in the malleable iron castings industry, who underscored the need for adjustments to make up for wages that total between 45 and 60 pct of total production costs.

Among many other complainants are metal lath, foundry, and shipping container industries.

Official response to these pleas, and many like them, has been essentially this: Supply data on earnings to OPS accountants and look for relief under earnings standard rules. If current pre-tax earnings, based on net worth, are less than 85 pct of average earnings in the best 3 of the 4 years 1946-49, with adjustments indicating changes in net worth, then OPS says it's ready to accept applications for higher ceilings.

However equitable this method of providing price relief appears in the official perspective, it contains a pair of pitfalls. Basis of the earnings standard is the belief that 1946-49 were "normal" earnings years and could serve as a base period for industry in general. Another assumption is that the data required for determining eligibility for relief can be obtained simply and conveniently from an examination of operating records.

Depressed Years — Fallacy of the first supposition has been revealed by a number of industry groups, including cement manufacturers and metal lath producers. The former consider 1946-47 as depressed years in their business, and lath producers say they were operating at considerably below capacity in the 4 years 1946-49.

Finding the statistics OPS wants also is a difficult task for some industries, as the steel shipping container manufacturers can attest. Only a small part of this production is done by single-line companies devoting all their effort to container output.

Integrated and multiple-line firms, which must include a variety of production items in their bookkeeping and therefore would find it hard to isolate earnings on containers, turn out the bulk of these articles.

"Good Gawsh! Mice?"

An industry which can visualize troubles by the gross in trying to get a price increase via the earnings standard route might be tempted to seize on General Overriding Reg. 29 as an alternative. This order makes available a percentage increase over current ceilings for a firm manufacturing an "essential" product. As a basis for the price rise allowed aluminum producers, GOR 29 was adequate, but it's a rare manufacturing firm that can qualify as essential under OPS standards.

Same Treatment — Some industries, reflecting on the price increase permitted steel producers, have wondered aloud why they are not eligible for the same consideration. A committee from the cast iron boiler and radiator industry put this question to OPS and thereby touched on a sensitive nerve.

Its position, OPS asserts in such cases, is that the settlement involving steel was made on specific direction of Office of Defense Mobilization. OPS had no choice. OPS wants to stick to the idea that a higher-than-Capehart price increase for steel did not set a precedent for other related industries.

Essentially, the OPS stand is that of a stubborn opposition to a pass-through of higher costs of labor, while parceling out earnings standards hikes to some qualifying companies. The agency shows it is determined to stand pat on the labor-cost issue, even when earnings studies made now will be out of date in November because of pending wage-boost agreements to be signed shortly.

Of its own future, the agency does not look too certain. A source close to the agency says officials on the next-to-top level believe there is no more need for controls to be maintained now than there will be next Apr. 30. On the other hand, Price Stabilizer Tighe Woods said on Oct. 2 that he is convinced of the need for retaining the restrictions.

NPA: Sees Tight Steel Supply

Administrator McDonald predicts no easing until second quarter . . . Should scrap controls "soon" but won't . . . CMP should be kept till July in case of recurring shortage.

Control officials in charge of both prices and materials seem to be riding a two-headed horse.

They agree on one hand that controls should be junked "as soon as economically feasible," a now somewhat hackneyed phrase in officialdom. At the same time they are making it clear that programs such as CMP are not to be scrapped in the near future.

Administrator Richard McDonald of National Production Authority says he agrees with mobilizer Henry H. Fowler who told the Senate-House committee on defense production that CMP should be continued at least until next July.

One reason, the new NPA chief says, is that if shortages should recur it would take from 6 months to a year to get the system back into operation again. In any event, he adds, there is little prospect for an early balancing of supply and demand for steel, copper, and aluminum.

Not Till Second Quarter—Despite the rapid snapback after the strike and the optimism of the steel industry, McDonald says, the supply won't be brought into balance with demand until well into the second quarter.

The way it looks now, he explains, including 5,500,000 ingot tons of new capacity expected to be completed during last half 1952, steel mills will be kept operating at full capacity until at least next May.

He concedes that the outlook may change somewhat after a meeting with steel officials in late October. First quarter order books will have then been open for a month.

"This will give us our first overall measurement on progress in liquidating past-due tonnage resulting from the strike, as well as the forward position of the mills," he states.

The Picture — Meanwhile, the NPA estimate of the situation is about as follows:

Combined defense and consumer demands will result in continued pressure on large size bars, sheared mill plate, wide flange structurals, and seamless pressure tubing.

Requirements for ammunition types and grades of steel will continue to increase through the first 6 months 1953.

Sheet and strip continue tight at present, due to carry-over tonnage. Indications are that supply will be in balance with "controlled" demand by first quarter.

Tin mill blackplate supply are good with an undersupply of CMP tickets issued for fourth quarter. More will be issued.

Ferroalloy supply is adequate to meet defense requirements but consumer goods industries will continue to suffer as to items requiring nickel, tungsten, cobalt and a few other materials.

In general, as the agency sums it up, the steel situation is brighter. But mixed trends in overall demand as of now indicate that consumers are able to more than absorb all steel output over the next several months.

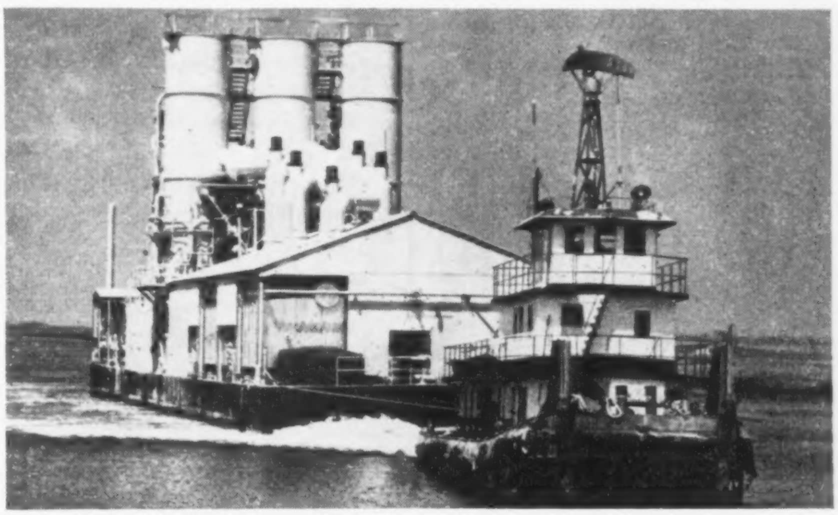
Allow Delivered Ceiling Hike

Manufacturers selling on a delivered price basis and governed by three basic manufacturing regulations now may increase their ceiling prices to reflect higher outbound freight costs on the basis of Office of Price Stabilization actions which became effective Oct. 2.

Those firms with products covered by the General Ceiling Price Regulation, CPR 22, and CPR 30 are in line to benefit by the actions if sales are made on a delivered basis. Manufacturers with a base period practice of selling f.o.b. plant have had and continue to have authority to pass along increases in outbound transportation rates.

Higher carrying costs include increases granted by Interstate Commerce Commission, contract-carrier rate increases authorized by OPS, and higher parcel post rates.

The Oct. 2 actions are Supplementary Regulation 122, GCPR; SR 35, CPR 22; and SR 9, CPR. 30.



FLOATING MINE: A tugboat tows a floating sulfur mining plant 65 miles from Grande Ecaille, La., to Bay Ste. Elaine in the Louisiana Bayou country. It was built for Freeport Sulphur Co. to extract sulfur from marshy area where cost of building a permanent plant would be prohibitive.

They allow for outbound freight cost increases since Mar. 15, 1951, for CPR 22 and 30 manufacturers and since Jan. 26, 1951, for those pricing under GCPR.

Industry Controls This Week

Alloys—Amend. Dir. 1, Scheds. 1 to 5, M-80 places allocations of alloying materials for melters and processors on a monthly basis.

Coal—Amend. 5, CPR 4 and Amend. 11, SR 13, GCPR authorize an increase of 20¢ per net ton f.o.b. mines on anthracite coal and also permit an adjustment of coke prices.

Coal—Amend. 7, SR 2, GCPR raises prices of anthracite and bituminous coal 25¢ and 35¢ per ton respectively.

Copper—Amend. 2, CPR 110 states that changes in foreign copper prices do not alter ceiling prices set for rolling and drawing services in the copper wire mill industry. Amend. M-16 permits companies that receive quarterly allocations to place advance orders for copper raw materials.

Farm Equipment—SR 34, CPR 22, SR 121, GCPR and SR 1, CPR 161 authorize manufacturers of agricultural and garden hand tools to raise their prices 8 pct.

Machinery—SR 8, CPR 30 provides methods of calculating adjusted ceiling prices under the Capehart Amend. for machinery manufacturers producing custom designed units.

Petroleum Projects—Rev. M-46 and M-463 ease restrictions on materials for small oil and gas industry projects. Delivery-order filing requirements are also relaxed.

Resellers—Amend. 4, SR 4, CPR 7 extends dates on certain pricing orders establishing uniform resellers' ceilings for manufacturers or wholesalers of brand-name items. Amend. 23, Amend. 13, SR 1, and Amend. 1, SR 6, CPR 7 modify retailers' record-keeping requirements.

Steel—Revoc Dir. 1, Sched. 1, M-6A removes the restriction which held warehouse deliveries of aircraft quality alloy steel to 500 lb per month per customer.

Terneplate—Amend. M-25 revokes all restrictions on the use of terneplate.

Government Inviting Bids

Latest proposed Federal procurements, listed by item, quantity, invitation No. or proposal and opening date. (Invitations for Bid numbers are followed by "B," requests for proposals or quotations by "Q.")

Letterkenny Ordnance Depot, Chambersburg, Pa.
Body and engine parts for var vehicles, 40 itm, 53-49B, Oct. 8.

Rock Island Arsenal, Rock Island, Ill.
Barrel assy, 1050 ea, 11-070-53-138B, Oct. 17.

General Stores Supply Office, Philadelphia.
Containers, rectangular, metal, 92640 ea, 1-1158B, Oct. 8.

Ordnance Ammunition Center, Joliet, Ill.
Tube, burster, M5 780000 ea, ORD 11-173-53-13B, Oct. 21.
Tube, burster, M19, 642000 ea, ORD-11-173-53-9B, Oct. 14.

Frankford Arsenal, Philadelphia.
Spare parts, gaskets, 15000 ea, ORD-53-SP-25, Nov. 3.
Spare parts for ballistic drive, 100000 ea, ORD-53-SP-19, Oct. 30.
Shafts — centrifugal, 490000 ea, ORD-53-155, Oct. 15.

Watervliet Arsenal, Watervliet, N. Y.
Spring, retainer, 100000 ea, 53-63B, Oct. 15.
Ejector, clip, 160104 ea, 53-63B, Oct. 15.
Alloy steel spindle, part for 155 MM gun M2, 500 ea, 33216Q, Oct. 7.
Steel spindle, assy, parts for 155MM howitzer M1, 3570 ea, 33216Q, Oct. 7.
Aluminum, steel saddle assy, parts for 60MM mortar M2, 4000 ea, 53-28, Oct. 16.
Aluminum bronze bracket, 8800 ea, 53-28, Oct. 16.
Steel tube, parts for 60MM mortar M2, 4002, 53-28, Oct. 16.
Steel clevis, parts for 60MM mortar M2, 5000 ea, 53-28, Oct. 16.

Navy Purchasing Office, Washington.
Release, torpedo nose, cap, 2497, 6732A-3, Oct. 20.
Dummy nose fuzels for 2.75 in. rocket, 114990, 6733-O-B, Oct. 28.
Supports, conveyors, 7000, 6713-B, Oct. 3.
Projectile plugs, cavity liners cap, 1456408, 6710-O-B, Oct. 28.
Charge suport disc, 1183140, 6736-O-B, Oct. 30.
Blades, hacksaw, 323000, 6744-B, Oct. 16.
VT fuze container mark 90-91, 797375, 6712-O-B, Nov. 6.
Tool sets, 1500 set, 6746-B, Oct. 27.

Contracts Reported Last Week

Including description, quantity, dollar values, contractor and address. Italics indicate small business representatives.

Replenishment of other motor vehicle parts, 7500 ea, $66,075, W. G. Avery Body Co., Inc., Jackson, Miss.

Replenishment of tank and combat vehicle parts, 740 ea, $31,598 Campeau Tool & Die Co., Wayne, Mich.

Replenishment of tank and combat vehicle parts, 150 ea, $29,716, Clark Cable Corp., Cleveland.

Replenishment of small arms parts, 50000 ea, $59,500, The Dayton Rubber Co., Dayton.

Replenishment of other motor vehicle parts, 718 ea, $75,410, Comet Industries, Franklin Park, Ill.

Replenishment of tools, 155 ea, $110,050, Topper Equipt Co., Matawan, N. J.

Replenishment of small arms parts, 7600 ea, $970,520, Farm-Rite Implement Co., Chicago.

Fire control systems, 290, $9,908,482, General Motors Corp., Flint, Mich., *L. R. Steffen*.

Spare parts, $27,730, Hyster Co., Portland, Ore.

Armored vests, 13000, $70,850, L. W. Foster Sportswear Co., Inc., Philadelphia.

Modification kit rocket aircraft, 5", M34, assy, 19000 ea, $198,018, Eisen Bros., Inc., Hoboken, N. J.

Replenishment of other motor vehicle parts, 14000 ea, $46,284, Bendix Aviation Corp., South Montrose, Penn.

Replenishment of other motor vehicle parts, 1500 ea, $48,105, Carren & Co., Inkster, Mich.

Replenishment of other motor vehicle parts, 26000 ea, $50,073, Carter Carburetor Corp., St. Louis.

Replenishment of other motor vehicle parts, 40000 ea, $51,680, Wagner Electric Corp., St. Louis.

Replenishment of other motor vehicle parts, 1477 ea, $74,750, Algonac Mfg. Co., Algonac, Mich.

Replenishment of other motor vehicle parts, 4774 ea, $639,763, GMC Corp., Pontiac, Mich., *J. P. McManus*.

Radar direction finding assy, 800 ea, $1,851,512, Hoffman Laboratories, Inc., Los Angeles.

Spare parts, $78,003, Airborne Accessories Corp., Hillside, N. J.

Generators, 650 ea, $73,283, LeJay Mfg. Co., Minneapolis.

Electric motors and repair parts for motors, etc., 144088, $762,047, General Electric Co., Philadelphia.

Repair parts for gas engines, 2000, $62,-487, Food Machinery & Chemical Corp., San Jose, Calif.

Valves and repair parts, 1230, $35,741, Atlas Valve Co., Newark.

Repair parts for diesel engines, 194, $44,000, General Metals Corp., San Francisco.

Repair parts for diesel engines, 975, $30,396, The Cooper Bessemer Corp., Mt. Vernon, Ohio.

Repair parts for interior communications equipt, 1263, $40,924, Sperry Products, Inc., Danbury, Conn.

Repair parts for diesel engines, 7337, $34,507, General Metals Corp., San Francisco.

Valve assy, 2430 ea, $35,995, Walter Kidde & Co., Belleville, N. J.

Services and material for repairs, var, $260,000, Piasecki Helicopter Corp., Morton, Pa.

Maintenance parts used on harnesses for engines, 6780 ea, $64,071, Titeflex, Inc., Newark.

Maintenance parts for R5D aircraft, var, $57,884, Douglas Aircraft Co., Santa Monica., Calif.

Maintenance parts for carburetor assy, 3852 ea, $105,879, Bendix Aviation Corp., South Bend, Ind., *G. I. Lyman*.

Truck, cab and chassis, 19 ea, $61,499, General Motors Corp., Pontiac, Mich., *J. P. McManus*.

Truck, cab and chassis, 8 ea, $17,094, Ford Motor Co., Washington.

—Construction—

Steel Inquiries and Awards

Fabricated steel awards this week:

150 Tons, Bucks County, Pa., high school building, Max Corchin, general contractor.

460 Tons, Lancaster, Pa., manufacturing building, Armstrong Cork Co., to Belmont Iron Works.

1300 Tons, Portsmouth, Va., power station for Virginia Electric Co. through Stone and Webster Engineering, Inc., Boston, Mass. to Bristol Steel and Iron Works, Bristol, Va.

Fabricated steel inquiries this week:

400 Tons, Philadelphia, bank building for Central Penn National Bank, bids due Oct. 11,

4919 Tons, Agawam and Springfield, Mass. furnishing, placing and painting structural steel for new South End Bridge across Connecticut River, 500 ft downstream from existing bridge. C. B. Raymond, Greenfield, Mass., district engineer. Completion date is June 30, 1954.

Reinforcing Bar Awards this week:

100 Tons, Willow Grove, Pa., Public Works Shop, Willow Grove Naval Air Station, Brothers Construction Co. Low bidder.

100 Tons, Ft. Meade, Md., engineering laboratory for Signal Corps, John K. Ruff, Inc., Baltimore. Low bidder.

Industrial Briefs

Incorporation—The incorporation of a non-profit foundation for scientific research in pure and applied science was announced by BJORKSTEN RESEARCH LABORATORIES of Washington and New York.

New Press Installed—LAKE ERIE ENGINEERING CORP., Buffalo, has installed a new hydraulic press for the breaking of steel billets used in the production of medium and large artillery shells.

Public Tours Resume—Public tours through the Fairfield Steel Works, Tennessee Coal & Iron Div., U. S. STEEL, have been resumed.

Opening—DENISON ENGINEERING CO., Columbus, Ohio, has opened a branch office at 4306 W. 63rd St., Chicago.

Receives Contracts — AF-BRILL MOTORS CO., Philadelphia, has received over $3,300,000 in government contracts, mostly for the purpose of remanufacturing motor trucks authorized by the Army.

New Company—Griffin Wheel Co., a subsidiary of AMERICAN STEEL FOUNDRIES, Chicago, will build a railroad wheel foundry at St. Hyacinthe, Quebec. The new company, Griffin Steel Foundries, Ltd., will begin operations in the summer of 1953.

Company Appointed — PRECISION METALSMITHS, INC., Cleveland, has announced the appointment of The Crandall Co. to its field sales organization.

Ice Breaker—Electric propulsion equipment for the U. S. Navy's newest, largest and fastest ice breaker will be built by WESTINGHOUSE ELECTRIC CO., Pittsburgh.

Expenditures—During its fiscal year which ended June 30, 1952, COLORADO FUEL & IRON CORP., New York, spent an additional $20,040,000 on its expansion and modernization program, increasing its total expenditures on this program over the last 10 years to $70,896,000.

Business Trip—Top level officers of GENERAL ELECTRIC CO. will leave on a trip which will take them to an unprecedented series of business conferences with nation-wide company representatives.

New Weapon—A new weapon in the fight against high taxes was announced by WARNER ELECTRIC BRAKE & CLUTCH CO., Beloit, Wis. The company has revised the record stub on all pay checks so that employees are given the cumulative tax total for the entire year to date.

Sole Distributor — THE NATIONAL SUPPLY CO. announced that it is now sole distributor within the Continental United States for Lister Diesel Engines, manufactured by R. A. Lister & Co., Ltd., Dursley, Gloucestershire, England.

Authority—The Federal Power Commission has given SOUTHERN NATURAL GAS CO., Birmingham, Ala., authority to expand its natural gas pipeline capacity by 40 million cubic ft daily.

Completion—A new transformer plant for Moloney Electric Co., designed by LURIA ENGINEERING CO., has been completed at 4410 Semple Ave., St. Louis.

New Service—A new type service for western industry was announced with the formation of WESTERN INDUSTRY SERVICES, INC., Denver, Colo. The company has dedicated itself to work for the advancement and growth of industry in the west.

Acquisition—Arrangements were completed for the acquisition of all common stock and possession of the plant of Kerotest Mfg. Co., Pittsburgh, by TUBE TURNS, INC., Louisville, Ky.

Election—W. H. Kelly, Jr., assistant to the general construction superintendent, Lummus Co., New York, has been elected chairman of the Safety Committee, NATIONAL CONSTRUCTORS ASSN.

Construction Begun—H. M. HARPER CO., Morton Grove, Ill., has begun construction on another plant addition which will house their newly developed Aero Div.

Conclude Negotiations—H. A. BRASSERT & CO., INC., has announced the conclusion of negotiations with certain parties in Dortmund, Germany, for the engineering and supervision of construction for a new blast furnace.

Method in European Car Building

European small cars better suited for their own market than U. S. models . . . Foreign design superior in weight distribution, attention on rear axle improvements—By *R. D. Raddant*.

Americans are inclined to scoff at the apparently cheap construction, piddling hp, and tiny size of European automobiles.

A closer look, however, indicates that behind their design and construction may be a background of engineering as ingenious in its own way as that which produces the comparative behemoth of the American auto industry.

The difference, according to a man who should know, is that European cars are designed to meet economic and social conditions that exist in Europe and its market today.

This was pointed out clearly at the Oct. 1 meeting of the Detroit Section of the Society of Automotive Engineers by Maurice Olley, director of research and development for Chevrolet. He started his automotive career in British companies and once served as chief engineer for Rolls Royce U. S. Division.

Different Needs — According to Mr. Olley, the interesting features in European cars are not so much in their size, but in the fact that they are made of different materials, put together in a different shape, to meet entirely different conditions of use.

"The European industry is realistic," he pointed out. "It attempts to meet the conditions that exist. It does not attempt the impossible task of changing the conditions."

Unlike Americans, who are fast becoming used to power steering, power braking, window lifts and other mechanical gadgets, European designers must gear their product to a different market. As Mr. Olley put it, "European manufacturers have to keep their imaginations under restraint and think rather how to make a minimum vehicle which there own employees can afford to use. . . . Their primary requirement is a four-wheeled vehicle which will protect them from the weather." In this respect, they appear to be highly successful.

Can American auto makers learn anything from European design?

According to Mr. Olley, Europeans are making much better headway in getting the weight balance between the wheels, instead of piling weight on the front end, and are "hopeful" about developments in replacing the rear axle.

Better Suspension—Because European roads are rough and few corners banked, European demands on suspensions are greater than on U. S. cars. The result is that European cars were first with independent front suspension and are still ahead of the rest of the world in rear axle improvements.

As Mr. Olley explains it, "Emphasis in America is on directional stability—in Europe on directional nimbleness."

Following are some of Mr. Olley's observations on specific construction details:

Frameless construction is rapidly becoming the orthodox way of building small and medium sized European cars. Five British cars and eight continental models have frameless construction. The important factor in frameless constructions is a 50 to 70 lb weight saving.

In engines, the European trend is to the square shape. British designers are now making a transition from long stroke engines, induced by prewar taxation based on bore size, to short stroke. Two cylinder engines are common and emphasis is on four cylinder engines. Most European engines are built substantially of lightweight aluminum for weight saving.

Good Performance — The Mercedes has a four cylinder, four cycle diesel which Mercedes is making at a rate of 900 a month. By American standards the noise of the engine is "outrageous," but road performance is said to be smooth with instant response to the accelerator. Consumption of diesel oil or kerosene is about 37 mpg, an important factor in gas-short Europe.

Considering high gasoline prices, this factor would rank as important anywhere.

Mr. Olley cautions against judging European cars by American standards. For example, if scaled down to dimensions necessary for European use, the American car would not seat normal size persons. It would be made of the same number of parts and therefore cost almost as much to build.

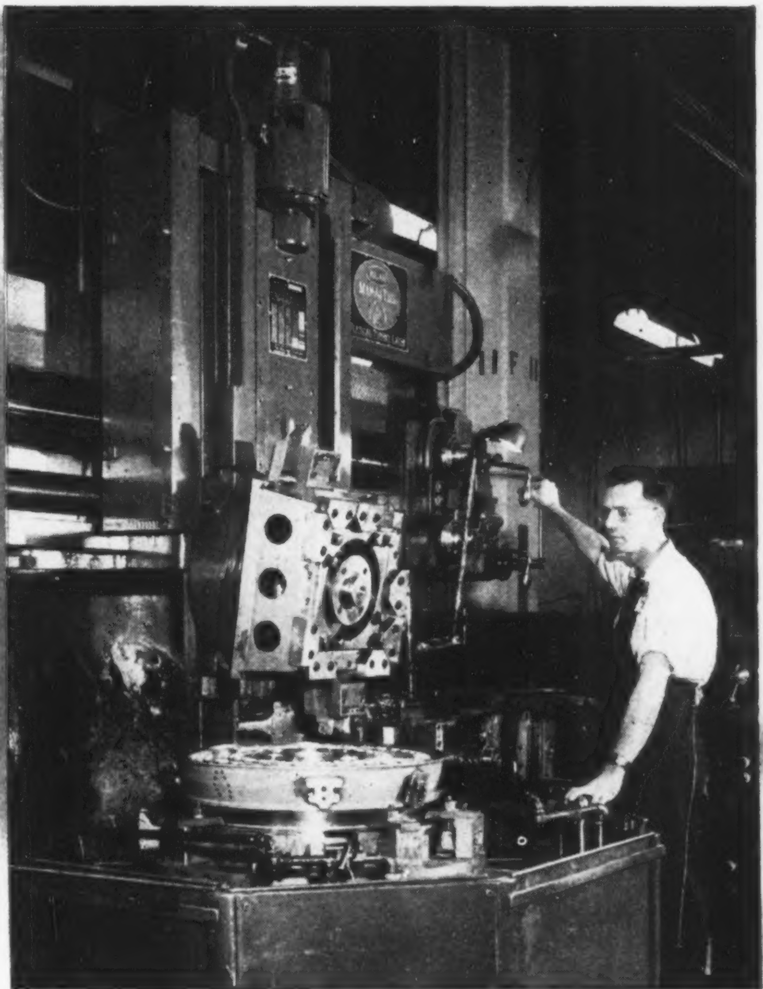
Automotive Production

(U. S. and Canada Combined)

WEEK ENDING	CARS	TRUCKS	TOTAL
Oct. 4, 1952	106,983*	31,354*	138,337
Sept. 27, 1952	110,145	31,083	141,228
Oct. 6, 1951	88,485	24,383	112,868
Sept. 29, 1951	84,606	29,367	113,973

*Estimated

Source: *Ward's Reports*



Pacemakers on the *Jet* PROGRAM

The inception of Man-Au-Trol Vertical Turret Lathe started a new manufacturing era in the boring mill field.

Man-Au-Trol manual or automatic control has taken the guess work out of previous manual operations on highly accurate repetitive work.

Automatic change of feeds and speeds at the proper instant, automatic change of direction of feed, automatic precision indexing of heads for succeeding operations — all contribute to the productive efficiency and minimum operator fatigue at a pace previously unobtainable in single spindle machines of the size and capacities of Man-Au-Trol.

For "set-ups" or shorter run jobs, manual operation is quickly available without disturbing the settings for the automatic cycle.

Learn about the manufacturing efficiency of this machine as applied to your work.

THE BULLARD COMPANY
Bridgeport 2, Conn.

. . . untouched by human hands!

. . . to plus-or-minus .035 oz.!

. . . at 12 per minute rate!

pistons balanced automatically

. . . by this amazing new

Morris

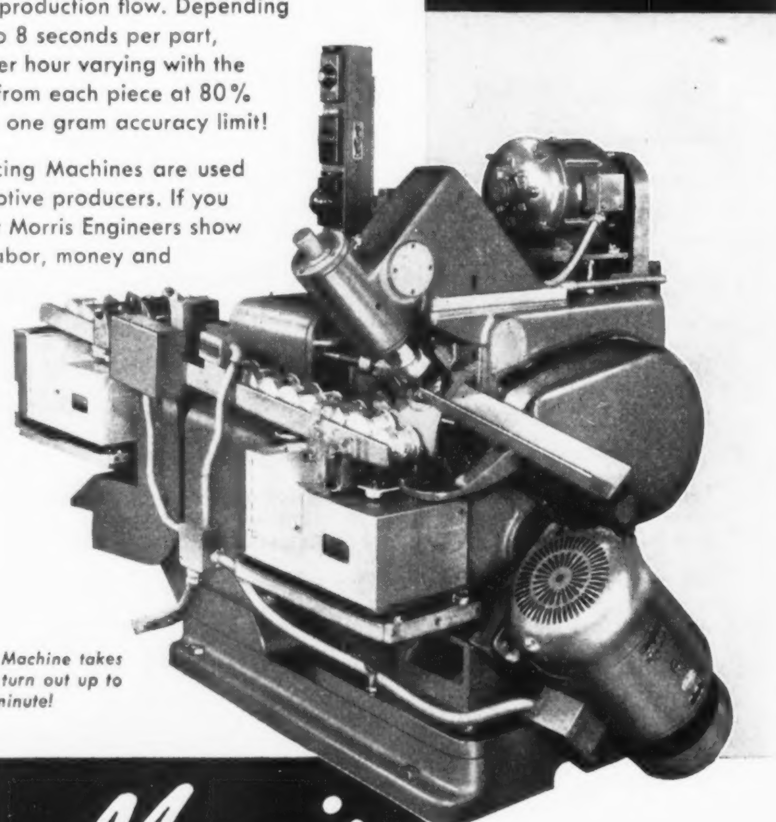
AUTOMATIC PISTON BALANCING MACHINE

For the first time, this MORRIS Mor-Speed Production Machine makes piston balancing 100% automatic. Parts are unloaded automatically from a standard conveyor, processed or rejected and returned to the conveyor "untouched by human hands."

Underweight or grossly overweight pistons are automatically rejected without interrupting the production flow. Depending on a cycle time ranging from 5 to 8 seconds per part, production is 450 to 720 parts per hour varying with the amount of metal to be removed from each piece at 80% efficiency and to a plus-or-minus one gram accuracy limit!

MORRIS Automatic Piston Balancing Machines are used by a number of the major automotive producers. If you have a piston production line, let Morris Engineers show you case history proof of time, labor, money and floor space savings.

Write today for NEW bulletin describing and illustrating the revolutionary MORRIS Piston Balancing Machine.



The Morris Automatic Piston Balancing Machine takes only 27.3 square feet of floor space to turn out up to 12 accurately balanced pistons every minute!

a better product at less cost with precision PLUS production

Builders of MOR-SPEED Line

Morris

THE MORRIS MACHINE TOOL COMPANY, 935 HARRIET ST., CINCINNATI 3, OHIO

MARKETING: Era of the Hard Sell

Industry faces most competitive year in a long time . . . Fanfare, major style changes part of high pressure sales era . . . Nash to produce light sports car in '53 . . . Automatic shift.

October will be the critical month in Detroit this year. It will bring in the first of the new models and produce the first indications of public reaction to the 1953 product.

At the same time, the always troublesome cleanup of 1952 models will be in its dangerous period. Dealers and parent companies alike pray they won't be caught with costly inventories. This does not appear to be a critical problem this year, however. Production lost to the steel strike generally wiped out any overflow that might have accrued.

Much Fanfare—Seldom in recent years has the introduction of the new models been accompanied by such a buildup in advance of first showings. Sales forces in all companies have been alerted, drilled and trained for what may be the first year of real competition in some time.

The industry has to look back only to early 1952 to recall the signs of market softness that threatened to make controls an academic proposition before the steel strike paralyzed the industry.

In almost every segment of the industry, major if not radical changes in styling, some new engines, and introduction of sports cars are expected to stimulate buying interest.

High Pressure—If the interest doesn't come naturally, the motoring public can look for sales techniques as aggressive as ever experienced. Sales executives mean it now when they warn that the days of waiting for customers to drop in are over.

One auto executive said pointedly that his sales force would have to employ vacuum cleaner or life insurance sales techniques with the persistent followup. His formula: Ten calls produce one request for a demonstration. Ten demonstrations produce one sale.

Sports Cars—Nash Motors is readying plans to jump into the light sports car race late in 1953 with production of its NXI that was first exhibited 2 years ago.

The new car will be built by two British firms for distribution in U. S. and Canada. Fisher and Ludlow, Ltd., will build the bodies and Austin Motor Co. will provide chassis and final assembly.

Nash spokesmen say that the new car will follow the modern "Airflyte" construction principles despite its being built abroad.

NXI was originally shown early in 1950 when it was billed as a "$1000 or less" convertible. It is a small two-passenger car with low sleek lines. The production car will be slightly larger and more powerful with a 42 hp engine and 85 in. wheelbase.

Automatic Shift—When torque converters and other automatic shifting applications hit the automotive industry, the general opinion was that the only field of development was in the direction of passenger cars.

Now it appears that tests of torque converters applied to heavy-duty trucks and off-highway vehicles have advantages of an opposite nature.

Instead of saving the driver the trouble of shifting, some tests have indicated that torque converters on heavy-duty vehicles have actually improved the life of the entire power train while also showing improved performance.

THE BULL OF THE WOODS — By J. R. Williams

Must Keep Modified Material Controls

Many shortages have eased . . . But modified controls are needed to insure defense schedules . . . Much war money still is unspent . . . Are we Buying American?—By G. H. Baker.

A good many, but not all, of the worst raw materials shortages have been overcome, but some modified system of controls will have to be continued to insure defense production schedules for many months to come.

This is the theme of the seventh regular quarterly report (covering third quarter 1952) to the White House from Office of Defense Mobilization, now headed by Henry H. Fowler.

As background, Mr. Fowler points out that Congress has appropriated $129 billion for defense and military construction and procurement purposes since Korea. About $99 billion has been spent or committed.

Commitments Top Deliveries—The catch is that out of this vast amount, only $41 billion (including construction) has been completed and delivered leaving $88 billion, including $30 billion as yet unspent, in various stages of processing, on order, or contract letting.

This means that two-thirds of the defense spending to date is yet to be translated into services or manufactured goods and delivered. This apparently is the basis for statements that defense production is not yet at peak.

Mr. Fowler says, that priorities powers will be necessary beyond next July—when the present Defense Production Act expires—if defense and military orders are to be delivered on schedule.

And in order to assure the proper working of the priorities system in getting materials, tools, and components to the right destination, there will have to be a supporting control system, at least on a standby basis.

Machine Tools Okay—A bright spot from the government's standpoint is that except for a few types of special purpose items, the machine tool outlook is no longer a headache. Backlog of orders has dropped from 23 months to an average of 12.

No immediate thought is being given to urging further steel expansion. A total of 13 million tons of new capacity has been added since Korea, the report states.

This means that the industry has completed 56 pct of the new capacity required to meet the government's recommended goal of 123 million tons by 1954—enough to assure an annual production sufficient for war and industry.

Airborne Titanium

About 530 lb of sheet titanium—instead of sheet steel—are to be used in production of certain airframe parts for the B-36 bomber.

Both military agencies and commercial firms have performed extensive research on titanium, which has excellent resistance to heat and corrosion. In non-structural uses, when replacing steel on a gage for gage basis, it can produce a weight saving of as much as 40 pct.

Scheduled date for a phase-out of B-36 production is 1954. The Air Force expects to use titanium in other aircraft, but cautions that more development work must be done before it becomes a common item in plane production.

By initiating use of titanium in the B-36, the Air Force hopes to open the way for greater demand for the metal.

May Need More — Latest increase for aluminum is an extra 200,000 tons to be built by 1955. Present thinking is that by that time it may be necessary to raise the sights again, perhaps as much as another 400,000 tons to be built in the following 3 years.

Electric power requirements, previously estimated at 107 million kw, are now seen as being too low by at least 10 million kw. The new target is 117 million kw by 1956, a 2-year extension of the completion schedule.

Efforts will be continued to get petroleum expansion on its feet. The government's goal is 50,000 to 55,000 new wells a year but indications are that drilling this year will not get beyond 45,000 new holes.

Likewise, efforts will be made to get freight car and locomotive production programs back on schedule. Present production rate is a sore disappointment to ODM. Freight car production this year has averaged less than 7000 units a month against the 10,000 rate deemed necessary.

Under the revised target, the production rate was to have gone up to 11,000 monthly as of October.

Buy American?—Circumvention of the so-called "Buy American" law by Pentagon planners is arousing the wrath of industrial area congressmen.

Little or nothing can be done to change the situation until the new Congress convenes in January. But mounting protests from manufacturing areas, particularly in the East, are forcing a showdown as to whether or not Congress meant what it said in the "Buy American" act.

"Ashamed" of Move—Move to suspend, in effect, the law was agreed upon jointly by the Defense Dept. and the State Dept. But Defense Dept. officials say privately that they are "ashamed" of the move, and claim it was "foisted off" on them by others.

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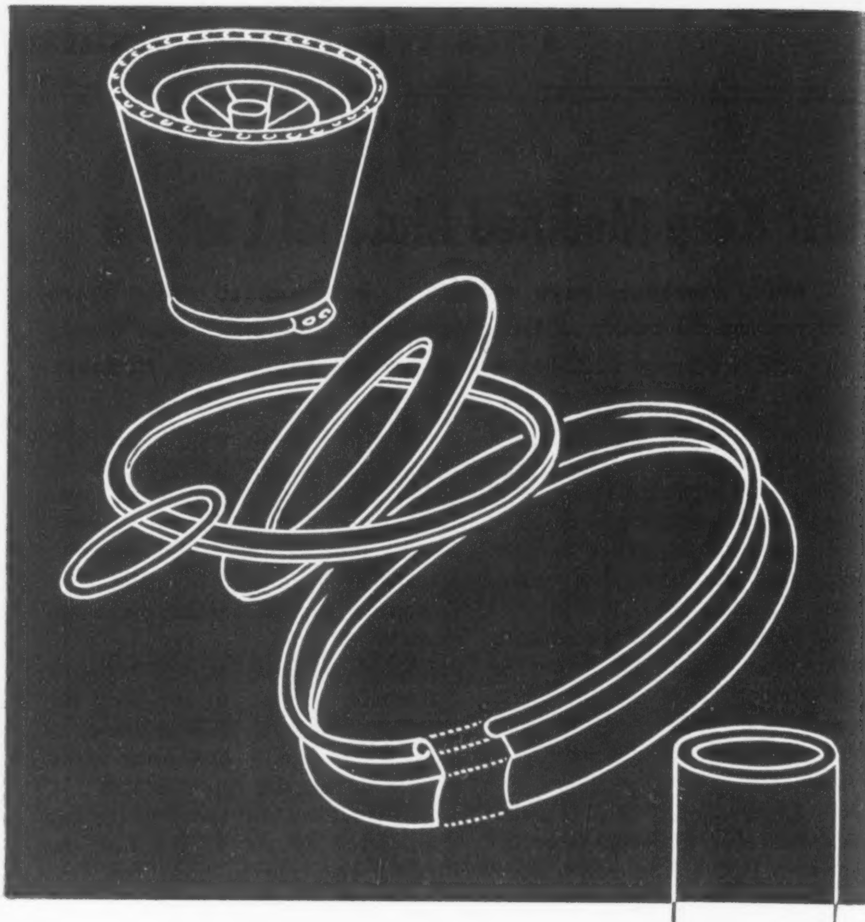

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METALS: Are We Meeting Our Goals?

Expansion aid from Washington seen as big factor in pushing up production of metals and minerals . . . Expect 40 pct iron ore increase . . . List other targets—*By A. K. Rannells.*

Government aid has been thrown behind more than $1 billion worth of industrial expansion for production of metals and minerals.

Another $500 million in government aid applications for mining expansion has passed initial screening and is being seriously considered.

These are the latest tabulations by Defense Materials Procurement Agency. Government assistance includes tax certificates, loans, purchase contracts, advances against production, etc.

Iron Ore—The government expects that this aid will yield at least $1.1 billion worth of new production by the start of 1955. Increased production of iron ore is a major target, officials say. Here, the target has been set at a 40 pct increase above 1950. Estimate of 1955 requirements are set at 147 million tons.

This includes production from foreign mines operated by domestic companies.

These figures do not include production of taconite, sintering, or other improved techniques for treating low grade ores. A program is underway to build up taconite output to about 15 million tons by 1955.

Coke — The Materials Policy Commission recently reported that expansion of coke production should be pushed. About 120 million tons may be needed by another 15 years.

Present goal is to get chemical coke capacity up to 84 million tons by 1955, a net increase of 10 million tons.

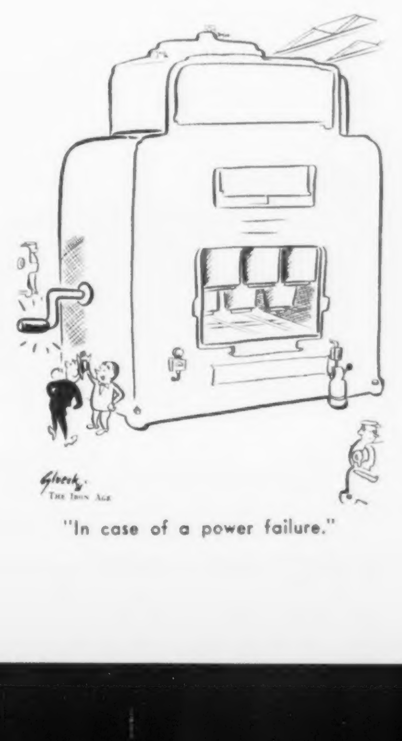
Most of the $677 million in coke industry applications for tax certifications have been processed (104 applications). The net result is certification to date of $550 million in new facilities, about $423 million going to integrated facilities, $125 million to non-integrated, and $2 million to beehives.

This covers an additional 17.5 million tons of new capacity. But this will be offset by loss of 10 million tons of old capacity between 1951-55, leaving close to 3 million tons of new capacity needed.

Manganese — Government planners have also established a goal of 2.5 million long tons of metallurgical grade manganese ore for 1955. This would call for an increase of 30 pct, or 630,000 tons, above the 1950 supply.

The total government program has worked out expansion goals for 17 different metals and 22 nonmetallic minerals. Industry has submitted nearly 1900 applications for expansion aid.

Of this total, 469 had been okayed and put into operation by the middle of September. Some 671 had been denied, and the remainder were in various stages of processing.



"In case of a power failure."

Some goals, such as for lead and zinc, are assured. But others range downward to 70 pct complete, a few even less. A brief summary of major programs follow:

Molybdenum—Expansion by 130 pct in domestic production (over pre-Korea) by 1955. Target is in sight.

Fluorspar—Goal calls for 50 pct increase in production. Already covered.

Nickel—A minimum increase of 35 pct by end of 1954, plus further expansion after that date. Goal partially in sight through reactivation of Nicaro facilities, loans, and tax certificates.

Copper—Goal by 1955 is 25 pct increase. In sight as result of subsidies (over ceiling prices), and other government aid. High cost mines are operating, plants have been expanded, and new properties are being opened up.

Zinc—Sufficient tax certificates have been issued and purchase contracts made to guarantee the proposed target increase of 15 pct in production through the next 2 years.

Lead—Target was only a 2 pct increase. Government has bought up 26,000 tons, will buy 4000 more.

Awards for War Production

Harold R. Austin, Munitions Board vice-chairman for Production and Requirements, heads a new 4-man Defense Dept. body set up to determine standards for production awards and to select those industrial firms winning such awards.

Comprised of one representative each from Munitions Board, Army, Navy and Air Force, the Production Awards Council will offer public notice of achievement by defense contractors in a program resembling that which produced the Army-Navy "E" awards of World War II.

Western Mills Help Out Detroit

Consumers can use all steel they can get, but rolling mill space is short . . . Excess ingots shipped to other plants for finishing as auto items . . . Foundry growth—By T. M. Rohan.

Western steel mills, traditionally in a deficit area, are giving a helping hand to steel-starved Detroit. A major West Coast mill with temporary excess ingot capacity is shipping ingots on an initial 12,000-ton order to Colorado Fuel & Iron Works at Pueblo, Colo. C.F.&I. is rolling the ingots into 4-in. billets for shipment to General Motors to make crankshafts. C.F.&I. has had temporary excess rolling capacity due to slow start-up after the strike and installation of mechanization equipment.

Other inter-regional shipments of ingots and billets are also being made by Isaacson and Seidelhuber in Seattle. Seidelhuber made a token shipment of steel for tubing last month and Isaacson is sending some tonnage to U. S. Steel.

Hard-up western consumers could now use every pound of steel made, but the mills did not have rolling time to finish the excess ingots.

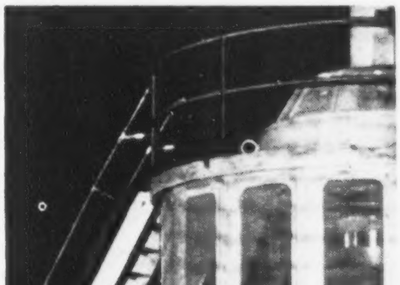
Shell Molding—In the wake of Stanford University's shell molding machine, unveiled 2 weeks ago, a small production model, believed to be the first of its kind in the West, showed up last week in Vallejo, Calif.

Vallejo Brass & Aluminum Co., a 2-man job shop huddled away in a government surplus plant, had understandably eluded the search by Stanford and western manufacturers for operating data on the Croning process.

M. H. Madiros, who is Vallejo Brass & Aluminum, has been turning out 100 shell molds per day for 3 months. He manufactures 2-lb aluminum bases for a unique telescoping light for police and emergency vehicles. He has an old gas-fired core drying oven necessitating a 3-min cycle.

Mr. Madiros went into shell mold production to replace conventional sand cores. With shell molding he was able to furnish castings with a 12-pitch, 1½-in.-diam thread and four mounting holes for the same $2 per unit price as previous rough sand castings which needed $1 worth of threading and hole-drilling.

Steel Propellers—Experimentation is now under way on stainless steel propellers to replace bronze. Although common in smaller sizes, difficulty of holding close tolerances in casting has largely prevented use in bigger ones. Some pioneering work has been done on machining propellers at the Philadelphia Navy Yard, but costly manual chipping and sanding is still the conventional finishing method.



MORE POWER: President Truman gets a closeup view of huge dynamo at Hungry Horse Dam which he dedicated last week.

Mare Island foundry has cast 13,000-lb, 10-ft-diam, 6-in.-thick bronze disc. Major operational problem is converting production line foundrymen to constantly changing job shop work traditional in Navy repairs.

Shipyard Expansion — New 11-ton Whiting tilting-type electric and 1500-lb Electromelt furnaces are now being installed at the Navy's Mare Island Shipyard in a general foundry expansion and mechanization program.

The foundry's biggest existing furnace is an 1800-lb unit which is supplemented by small indirect arc furnaces. Other new equipment pending final OK includes a dielectric sand core drying oven and 3000-lb Detroit indirect arc furnace. The foundry, employing 180, specializes in job shop repairs and is western headquarters for making Navy propellers.

Scrap Indictment — Early last March Office of Price Stabilization agent Robert Ewing in Seattle, posing as a scrap iron dealer, reported he was paid prepared scrap prices for unprepared material at Northwest Steel Rolling Mills. One delivery was 3000 lb, the other 4730.

Last week in Seattle OPS got a federal grand jury indictment charging the firm and two weighmasters with price violations. Rumor had it others were also in the offing. Other dealers were quick to point out the government apparently illegally sold scrap over ceiling and that the unprepared scrap was hidden in with prepared lots.

Safety Valves for Production

Tool output must be maintained at adequate level for quick shift to all-out effort . . . NPA outlines ways . . . Pool orders, stockpiling, tax revisions suggested—*By E. C. Beaudet.*

To meet the demands of an all-out war, machine tool production must be kept high enough to permit the industry to shift to full mobilization output without delay. Proposals for maintaining this level were outlined last week by Ralph Howe, director of National Production Authority's Metal Working Equipment Div.

Speaking before members of the American Machine Tool Distributors' Assn. in Virginia Beach, Mr. Howe reflected NPA's views on pool orders, expansion of facilities for long term equipment and revision of depreciation laws.

Can't Go On—While the industry is expected to maintain a good volume of business until the middle of next year, builders of small, short lead-time tools are already feeling the pinch of defense cutbacks and contract completions. Present shipment rate of more than $100 million worth of machine tools per month cannot be maintained for long. But the industry must continue to produce enough to keep its labor force intact in case of an all-out war.

Builders of small machine tools will have to find their own production levels once the impact of defense buying has passed, and they prefer it this way, Mr. Howe said. But the problem of what to do about firms whose business falls off so badly that they are unable to keep their labor force intact must be anticipated. Mr. Howe suggested machine tool pool orders as the solution.

Tool Pools—Since the government knows which types of machine tools are in greatest demand in war time, pool orders covering these tools could be drawn up. They would be activated only for companies whose business fell below the level required to maintain its skilled labor force.

Orders would be given in certain quantities and normal production lots. The amount of business a firm would have to lose before it became eligible for a pool order would vary with each company. It is estimated that 50 pct of present production would be the critical point for some companies.

To expedite production of machine tools in an emergency, particularly long lead-time equipment, Mr. Howe suggested that pool orders should be given by the government for certain components and materials such as forgings, bearings, clutches, castings, etc. These would be bought by the government and stored and maintained in builders' plants. In the event of full mobilization they could be drawn from these reserves and put into production. Government investment would be minor but it would save from 5 to 6 months production time.

"Our De-Luxe model for executives who want to keep their hand in."

More Incentive—Present backlog of long lead-time tools for defense is still heavy and some delivery dates will not be met, Mr. Howe stated. To solve this problem a thorough anaylsis of delivery requirements must be made to put them on a more realistic basis. In addition, the government must offer builders more incentive to expand facilities.

These incentives might be in the form of full tax write-offs on new facilities added during emergency periods.

Tax Revision—Perhaps the best method of enabling the industry to continue at a healthy operating rate would be reform of the present tax structure and depreciation laws. This would result in increased buying of new machine tools and create more up-to-date production equipment. It would be a much better way of preparing the country for a national emergency than storing of a multitude of end items subject to obsolescence.

These proposals, Mr. Howe said, have been made to the Advisory Committee on Production Equipment, known as the Vance Committee. The final report of the committee is not expected to be issued until some time next month.

Officers Elected—On the closing day of the meeting John M. Riordan, Riordan Machinery Co., Detroit, was elected president of the association. He succeeded E. J. Seifreat, Seifreat-Elstad Machinery Co., Dayton. E. R. Motch, Jr., Motch & Merryweather Machinery Co., Cleveland, was elected first vice president and Thomas R. Rudel, Rudel Machinery Co., New York, was made first vice president. The secretary-treasurer, G. B. McClennen of the Delta Equipment Co., Philadelphia was reelected to that office.

Steel Prices Hit a Higher Level

Higher wage scales and soaring costs up steel prices from $2.50 to $4.50 per ton . . . Mills are booked into '53 . . . Some shortages, but supply expected to improve—*By F. Sanderson.*

New higher wage scales and soaring costs have moved Canadian steel prices upward. Boosts are on a sliding scale depending on the product concerned. But a few items were left unchanged including galvanized sheets, nails and some wire.

New price lists will show advances from $2.50 to $4.50 per ton, depending on type. Bars and plate were moved up $3.50 per ton as was cold-rolled sheets, while hot-rolled sheets advanced $2.50 per ton.

New Orders Heavy — Canadian steel mill representatives report heavy volume of new business. As a result of the outpouring of orders this fall, mills now are booked solid through the last quarter and some business has been placed for first quarter of 1953.

Shortages remain in some lines of steel and consumers are on a quota basis with regard to delivery. It is not expected there will be any improvement in tonnage allowable this year. Defense projects and production are taking more steel as new plants swing into operation and consequently draining off some consumer goods supply.

Easing Supply? — Prospects favor easing in supply early in the coming year when Canada's enlarged steelmaking capacity swings into operation. Also imports of steel from the United States are expected to run heavier in the future.

While government controls on steel are still in force, steel producers are largely handling deliveries under minor guidance from the Steel Control office. It is understood that most controls will be abandoned by the government by the end of the first quarter, 1953.

Nickel Contract—Defense Materials Procurement Agency (U. S.) contracted with two Canadian firms for purchase of up to 65,000 short tons of crushed nickel ore.

Production will come from the Sudbury district of Ontario. Under the contract, East Rim Nickel Mines, Ltd., will start mining at least 3500 tons monthly from its Sudbury holdings.

East Rim has no processing facilities. However, under a companion contract, Falconbridge Nickel Mines, Ltd., will put the ore through the first stages at Ontario. It will then be shipped to Kristianstad, Norway, for final processing.

Prices to be paid range from $4.33 a ton for 1 pct nickel content up to $15.39 a ton for 2.2 pct or more nickel content.

Holdings of East Rim are estimated to contain deposits of well over 2 million tons of nickel bearing ore.

"Feel that grip, boss. Your son's crushing my hand."

Film Showing—The Steel Co. of Canada Ltd., last week gave a showing of its new film "Steel for Canadians" to an audience of several hundred industrial and business leaders at the Royal York Hotel. The movie presents a detailed story of steelmaking in the Hamilton works of Stelco from the first introduction of iron ore and other raw materials right through to the finished products.

Stelco's works is producing at a rate of more than 1,250,000 tons of steel a year, and when the present $60 million expansion program is completed late this year, steel production at the Hamilton Works will jump 50 pct to more than 1.9 million tons a year.

Stelco is said to manufacture a wider variety of steel products than any other company currently operating anywhere in the world. It produces more than 15,000 items in the steel lines.

This is to supply the needs of a varied market.

Scrap Supplies — Steel mill, foundry and scrap dealer representatives convened in Toronto last week to discuss ways and means of increasing iron and steel scrap supplies and iron out knotty problems regarding specifications and classification.

The talks had two main purposes —discussions of ways and means of maintaining an adequate flow of scrap for Canada's fast growing steel industry. Dealer-consumer discussions also focused on getting a modernized code of specifications for scrap grades.

The meeting indicated that present scrap supplies are thought to be adequate for current mill and foundry needs. New steel capacity is being built at a cost of some $100 million. When this comes into production late this year or early 1953, increased demands could cause some shortages in the winter or spring months. Even if scrap supplies continue adequate, shortages may develop in some grades.

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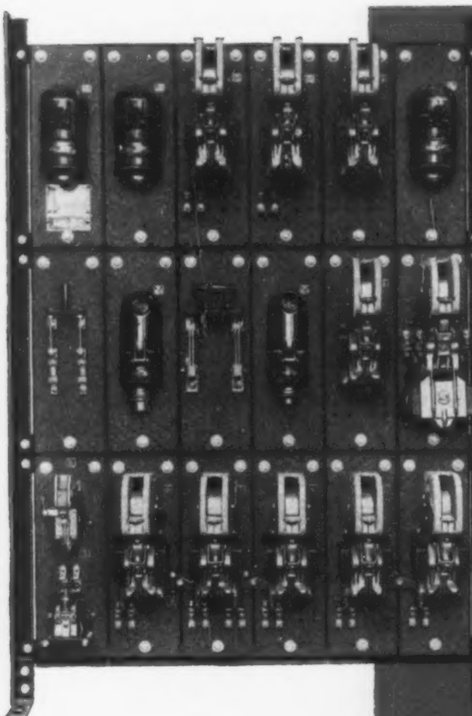

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Alliance charging Machine with EC&M Manual-Magnetic Disconnect Switch.

Meets crane specification for disconnect-means on footwalk and in crane cab. Only one unit to install—push button permits disconnecting the crane in an emergency from the cab.

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Has auxiliary contacts for controlling signal lights—provision for padlocking in off position—front-connected leads—ample wiring space.

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Whether you need mammoth heat treating equipment requiring shipment by flat car or a midget unit you can hold in your hand, Pressed Steel Co. can fabricate the unit you want. Shown in a new brochure is some of the equipment PSC has made for specific applications. Since virtually all heat-treating equipment is custom-built, the catalog was put out primarily to show the versatility of the company's facilities. *Pressed Steel Co.*

For free copy circle No. 1 on postcard.

Building repairs

No matter what kind of wear, tear or other damage your plant has undergone, you'll probably find a repair product to fix it up described in a new booklet available from Stonhard Co. Just as an indication of the wide scope of maintenance problems that can be solved, Stonhard has a product to repair rutted floors, broken floors, leaky roofs, splintered roofs, rough floors, oily floors, acid conditions and spalled walls. The booklet is conveniently indexed to give the desired product needed to solve different maintenance problems. *Stonhard Co.*

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Melting pots

ACF melting pots have been designed expressly for use in aluminum foundries, diecasting plants, battery plants and smelting works. The pots have a gradually tapering thickness and sloping side-wall angles to resist swelling and distortion after the pot has been in use. A bulletin is available giving complete information on the pots. *American Car & Foundry Co.*

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Welding

For low cost production and maintenance welding, the A. O. Smith Challenger ac welder is the answer. Main feature of the unit is its wide welding range. For example, with the 400 amp model it is possible to weld 3/32-in. diam electrodes at 75 amp or go as high as 585 amp when using the largest diam electrodes. More data is contained in a new folder. *A. O. Smith Corp.*

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Hydraulic cylinders

Dependability and ruggedness of Lindberg hydraulic cylinders have been proven in virtually every field of industry. Adaptable for a wide variety of uses, the cylinders are covered in a new 28-p. bulletin. Diagrams, photos and charts are included to explain the different mounting types available. *Lindberg Engineering Co.*

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Facing alloys

Detailed information on Colmonoy's line of hard-facing alloys designed to prevent wear is contained in a new folder. An extremely handy feature of the publication is the indexed guide to alloys for specific applications. *Wall Colmonoy Corp.*

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Sprocket wheels

It's sprocket wheels that make conveyers go 'round, and in a new catalog Link-Belt Co. lists more than 200 sizes of cast tooth sprocket wheels available from stock. There are wheels for 78 popular types and sizes of chains, including Ewart Link-Belt, Class 400 pintle, Class SS bushed roller, Class H pintle and Class C combination chain. In addition information is given on how to select sprocket wheels. *Link-Belt Co.*

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Synthetic rubber

Outlined in a new leaflet are Acadia Synthetic rubber products. Included are molded items, extruded shapes, sheet and roll goods, die cut parts and silicone rubber parts. In addition, the derivation of the 5 basic types of synthetic rubber is diagramed to show the raw materials used to make the end product. *Acadia Synthetic Products Div., Western Felt Works.*

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Drills

Cincinnati Lathe & Tool Co.'s 14-in.-3000 Sliding Head Floor Drill is illustrated and described in a 4 p. specification sheet. This general purpose drill has six speeds. It is equipped with ball bearings and full-floating drive. *Cincinnati Lathe & Tool Co.*

For free copy circle No. 9 on postcard.

Heads

Metal heads are frequently used as end closures for different types of pressure vessels, tanks and boilers. But they are also suitable for such uses as ladle and melting furnace bottoms, ends for annealing pots, gear and grinder guards, special wheels and other applications calling for an integral, continuous flange on a circular steel plate. In a new bulletin available from Joseph T. Ryerson is a listing of the company's ASME and Standard Types of flanged and dished heads available for immediate shipment from stock. In addition, there is general information on other uses for these units. *Joseph T. Ryerson & Son, Inc.*

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Rectifiers

Selenium rectifiers are heavy capacity units developed to change high voltage ac to dc. The rectifiers come with either manually operated or automatic circuit breakers. Specifications and complete details are listed in a new leaflet. *Syntron Co.*

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Arc welding

An interesting series of photographs and articles on welding is contained in Vol. IX, No. 1 of the Hobart *Arc Welding News*. Some of the topics discusssd are discoloration and warping problems, arc welding as a substitute for riveting and the development of a welded elevator. *Hobart Bros. Co.*

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Electrical controls

Particularly practical for machine tools are the Square D reversing drum switches and fractional hp manual starters described in a new folder. The reversing drum switch is applicable wherever rotation direction of a small motor is to be controlled manually. The manual starter, which is available in a variety of enclosures, has also been designed for small motor use. *Square D Co.*

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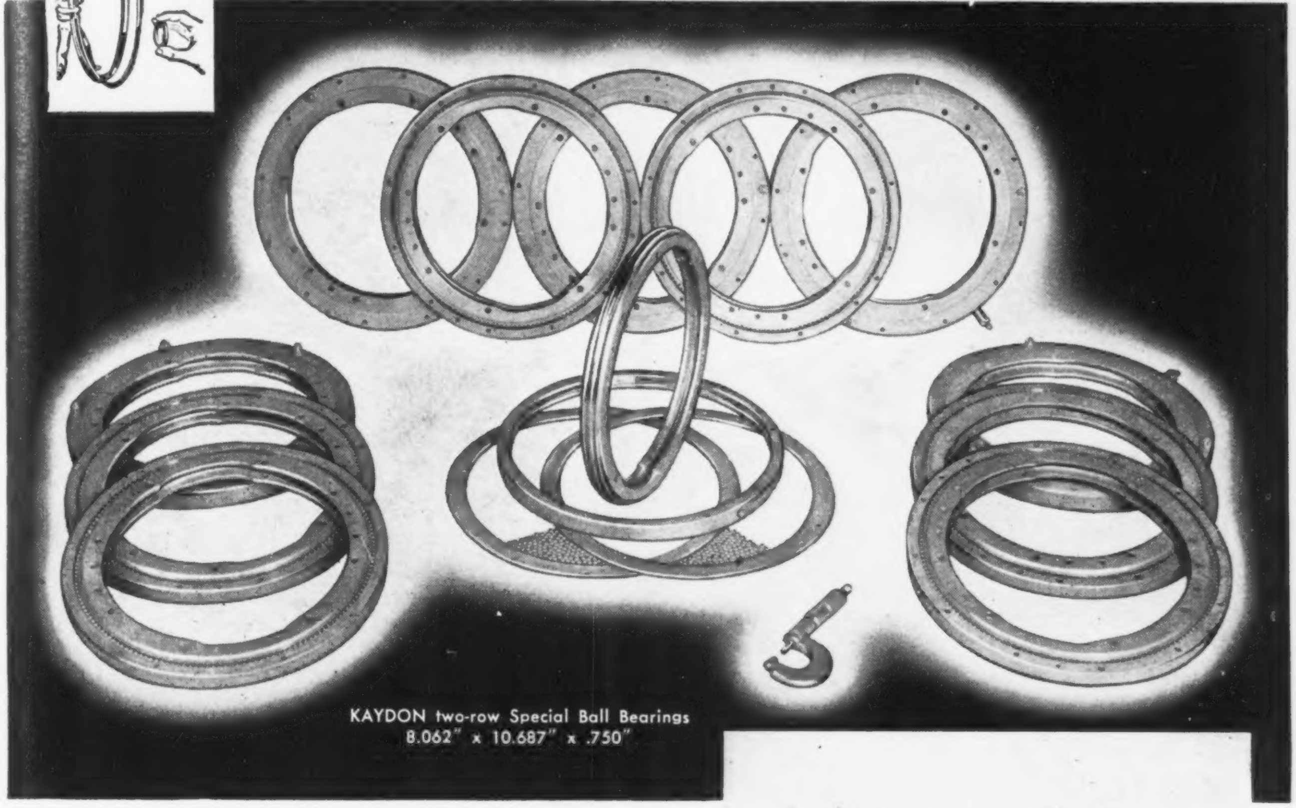

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PRECISION BALL AND ROLLER BEARINGS

Spray nozzles

For cleaning, cooling or descaling with water, Chain Belt Co. has a spray nozzle that will do the job efficiently. Rex Spray Nozzles, described in a new circular, provide a high velocity spray with a thin, flat line of impact to give sharp cutting action. To handle water pressures ranging from 20 psi to above 1000 psi, the nozzles come in different metals designed for specific pressure ranges. *Chain Belt Co.*

For free copy circle No. 14 on postcard, p. 225.

Cranes to plants

From a standard slewing crane to a fully equipped industrial plant, the German firm, Ardeltwerke G.m.b.H., promises a high quality product. Briefly sketched in a new folder is the company's startlingly extensive array of products. Included are cranes for numerous heavy duty applications, diesel shunting locomotives, induced draft blowers, equipment to fully outfit a pipe foundry. In addition, a complete iron plant is offered including original design, construction and installation of equipment. *Ardeltwereke G.m.b.H.*

For free copy circle No. 15 on postcard, p. 225.

Volt-Ammeter

Columbia Volt-Ammeter, recently introduced to the trade, is a clamp-type, hand-size instrument for use with alternating current. It measures up to 600 amp with four current ranges and up to 600 v with two voltage ranges. More information on this unit is available in a new mailing piece. *Columbia Electric Mfg. Co.*

For free copy circle No. 16 on postcard, p. 225.

Vises

Producto vises, outlined in a new leaflet, prevent accidental milling or drilling of vise parts. Included in the circular are technical details on the three models of the 6-in. vise available: Plain vise with ground sides, plain vise with clamping ears and swivel vise with graduated base. *Producto Machine Co.*

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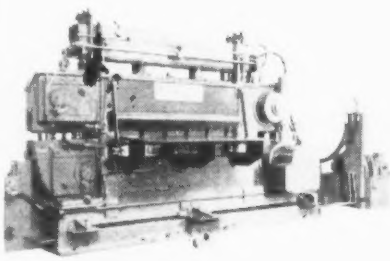
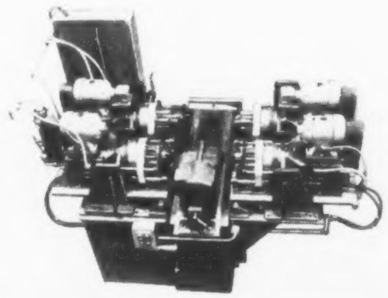


Flash trimmer used in rolling mill line

This new rolling mill flash trimmer is designed for use in a continuous process rolling or pickling line. It is placed in the line adjacent to the flash welder which joins coils of steel to form a continuous strip for processing. The welded sheet is moved to the approximate center of the trimmer which is provided with hydraulic horizontal traverse 6-in. each way from center for final alignment of the machine with the weld. Materials 0.056 to 0.250 in. thick can be trimmed. Thinner and thicker materials can be trimmed with special cutters and clamping dies. *Morton Mfg. Co.*

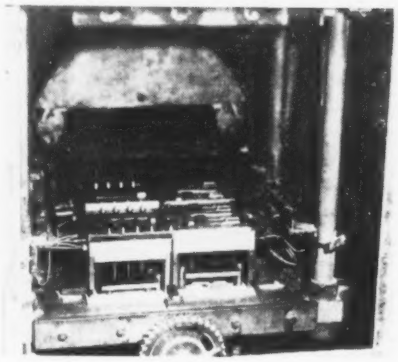
For more data circle No. 18 on postcard, p. 225.



Automatic machine drills transmission cases

A special two-station drilling and tapping machine drills and taps six power take-off holes on each side of seven different transmission cases. The machine is designed with angular, side and vertical adjustments to accommodate the differences in the relative positions of the holes. The machine's four hydraulic feeding units and four gearless drill heads are standard equipment. The hole patterns in the heads, and adjustments for drilling angles, requires special engineering. The machine is completely lubricated from a central system. *Zagar Tool, Inc.*

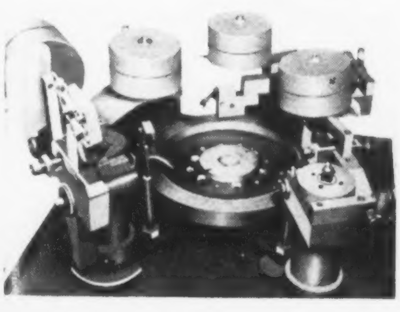
For more data circle No. 19 on postcard, p. 225.



Shell molding equipment available to foundries

New shell molding equipment makes it possible for foundries to take advantage of the production possibilities of the shell molding process without heavy expenditures for experimental and development work or equipment. A completely automatic machine turns out approximately 20 complete shells from a single set of dies every hour. Simple and dependable in operation, this machine performs all steps of the shell molding operation, delivering finished shells ready for pouring or storage. The machine accommodates dies up to 12 x 18 in. This Bachner die-molding machine is installed at an initial cost and rented by the foundry on a use basis. *Powdered Metal Products Corp. of America.*

For more data circle No. 20 on postcard, p. 225.



Carbide surface grinder reduces diamond cost

For production of solid carbide blanks, a multiple head surface grinder produces a finish of 1 to 2.5 rms and gage block flatness, using a 150 grit diamond wheel. It holds dimensions to ± 0.0002 in. The process used permits a wheel to be dressed and trued to 0.0005 in a few minutes. Longer wheel life is assured, reducing diamond cost from 20 to 50 pct per unit. Diamond salvage is less than 1 carat per lb of sludge. No skilled labor is required. *Spike Mfg. Co.*

For more data circle No. 21 on postcard, p. 225.

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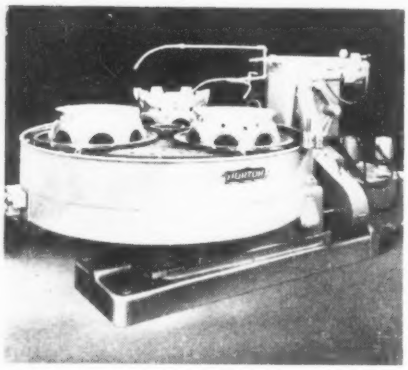
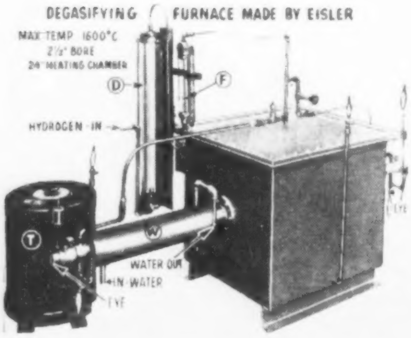


Flat lapping machine has 60-in. single face

Equipped with a 60-in. diam segmental bonded abrasive lap, a new flat lapping machine provides a superior means for lapping large parts. On soft metal parts it produces in a minimum of time a clean, finished surface free from grit either embedded or trapped in pores or crevices. Advantage of producing a clean surface on soft metal parts makes it possible to lap these to provide seal surfaces, wear surfaces, or surfaces to be subsequently drilled or milled, without an immediate cleansing of the parts after lapping. The bonded abrasive produces bright surfaces that require no subsequent polishing operation. Accuracy is maintained throughout the life of the lap by a simple diamond truing operation. *Norton Co.*

For more data circle No. 22 on postcard, p. 225.



Degasifying furnace for small metal parts

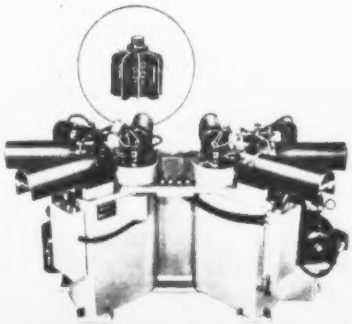
An improved degasifying furnace for radio tube and metallurgical industry can be used for small metai parts which have to be surface cleaned and degasified for further processing. The furnace is a complete unit with the fast drying tower and flow control gage mounted on the furnace top. The temperature regulating transformer can be placed anywhere for convenience. Heating chamber is 24 in. long x 1 to 12-in. ID. Loading can be intermittent or continuous. Maximum temperature for safe operation is about 2900°F. Gases in use for the furnace are hydrogen, nitrogen, a mixture of both. *Eisler Engineering Co., Inc.*

For more data circle No. 23 on postcard, p. 225.

Unit suited for production line testing

Combining high temperature, low temperature and humidity, a new test chamber for production line and experimental testing has a temperature range from + 250°F to —100°F. Accelerated pull-down is one of the features offered in the unit which can be cycled from ambient to —100°F in 45 min and can be cycled from —100° to + 200°F in 30 min. Both high and low temperatures are governed by a temperature controller. Humidity is regulated by a wet and dry bulb controller which provides 95 pct relative humidity at temperatures between 75° and 95°F. Vacum equipment can be added to simulate high altitude conditions. *Industrial Freezer Div. Webber Appliance Co., Inc.*

For more data circle No. 24 on postcard, p. 225.



In-line drilling units speed fin production

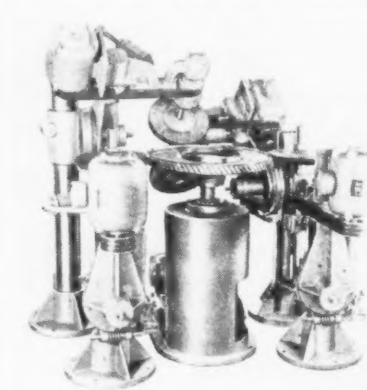
Eight traversing motor shaft type drilling units designed into a special machine speed production of 6 mm mortar shell fins. The equipment is completely automatic. The two station unit employs only one operator for feeding and unloading both stations at the end of each cycle. The machine drills sixteen 2/16-in. holes in each fin, drilling the four upper holes, indexing 180° and drilling the remaining four upper holes. The workholding spindle raises and the operations are automatically repeated for the 8 lower holes. Absolute accuracy is said to be maintained and output has been speeded up to 300 to 400 fins per hr. *Black Drill Co.*

For more data circle No. 25 on postcard, p. 225.

—**New Equipment**—
Continued

Foundry machine

A new foundry machine, Model ME-2F, is used for cutting the gates and risers from large castings. It is so constructed that the cutting can be done with the radial arm positioned above the work table. For castings which are too large to be placed on the table, the arm can swing behind the table, and the gates and risers can be removed with the casting resting on the floor. *DeWalt Inc.*
For more data circle No. 26 on postcard, p. 225.



Head for jet program

A new polishing head has been developed for the fast, accurate and economical deburring of turbine disk-slots. It incorporates several Murray-Way universal-positioning features. The head may be used with either wheels or buffs and is compact for use in groupings practical with a minimum of floor area. In the turbine disk-slot operation two, three or four heads are used as the work requires. Heads may be dropped or added easily if found necessary. *Murray-Way Co.*
For more data circle No. 27 on postcard, p. 22

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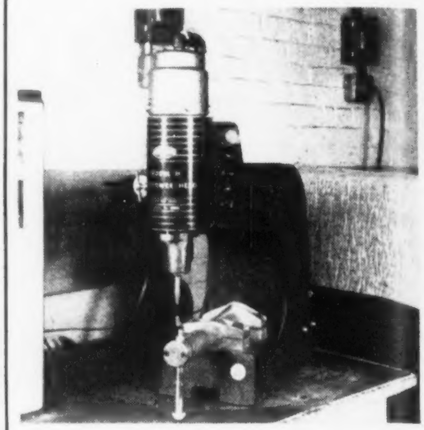


Fastening metals

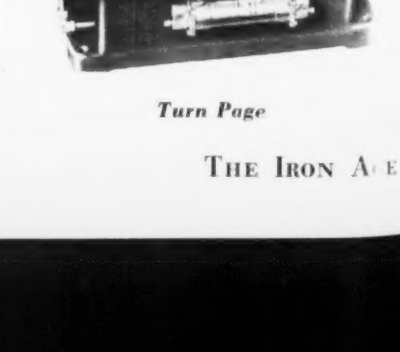
New Weldpower units that make use of the principle of stored energy join metals on a production basis, including ferrous, nonferrous and dissimilar metals. Energy is stored in the interval between welds, and discharged at the electrode tips in a pulse of high voltage and exceedingly short duration. This makes it possible to fasten metals of different melting points quickly, economically, without burning or oxidation at the point of the weld. *Raytheon Mfg. Co.*

For more data circle No. 28 on postcard, p. 225.

Change speed units

Standardized change speed units are positive, reliable geared drives, using herringbone gears throughout. They provide definite ratios of speed reduction, speed increasing, or a combination of both. There are no belts to wear out and cause speed variations. Two, 3 and 4 speed combinations, in a wide range of ratios and horsepowers are available. *Philadelphia Gear Works, Inc.*

For more data circle No. 29 on postcard, p. 225.



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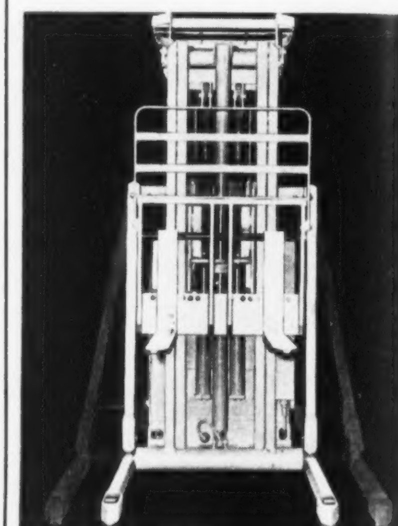
Adjustable base forks

Adjustable base forks for handling pallets of various widths are optional equipment for a line of straddle-type electric tiering trucks. The forks permit Raymond trucks to handle pallets varying from 32 to 48 in. wide. Made of rugged welded steel sections, the forks are hinged to the main frame and adjusted manually by a screw arrangement. *Raymond Corp.*

For more data circle No. 30 on postcard, p. 225.



Gaging system

A new versatile micro-step gaging system is an integrated and related series of gaging items that make it easy to use gage blocks directly in everyday gaging operations. Nucleus of the system is a series of gage block holders and end standards which are used to construct innumerable gaging and layout setups up to 72 in. long in steps of 0.000025 in. A time-saving, precalibrated dial indicator is used for constructing precise indicating type gages. Other components of the system include 5 and 10 in. sine plates and a book that lists directly the gage blocks to be used in forming 10,000 different dimensions and which instantly gives the correction to be made when checking non-steel parts with gage blocks, at temperatures above or below 68°F. *DoAll Co.*

For more data circle No. 31 on postcard, p. 225.

Turn to Page 244

for Defense Production

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Write for Bulletins

Manufacturers of a Complete Line of Sheet Metal Working Equipment Ranging from Small Hand Tools up to Large Power Operated Machinery.

Niagara Power Squaring Shears. Capacity from shim stock up to 1 inch thick steel. Lengths 3 feet to 20 feet.

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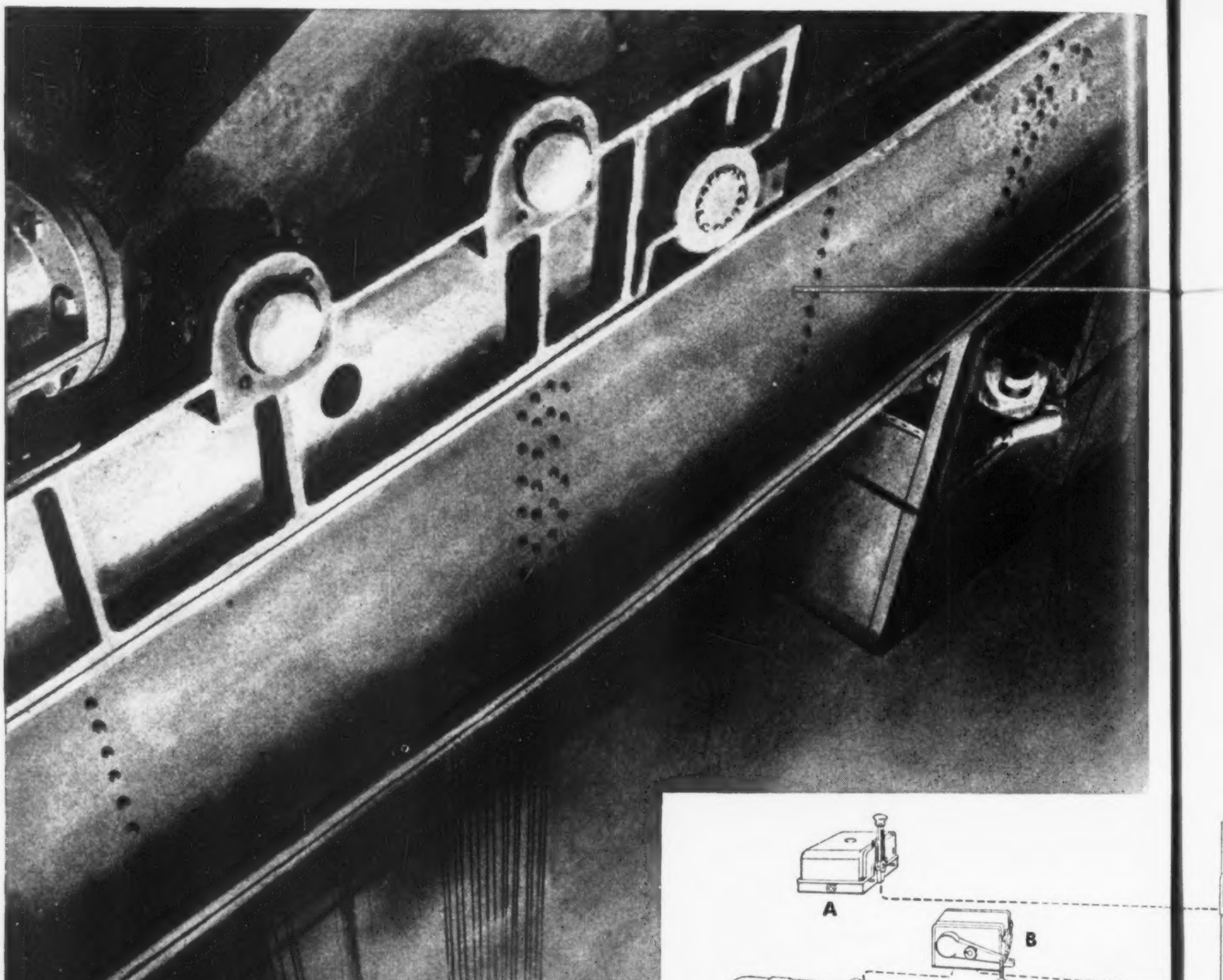
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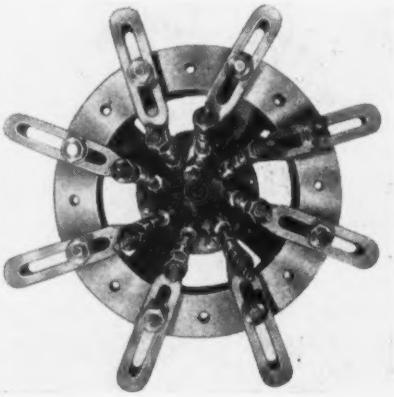
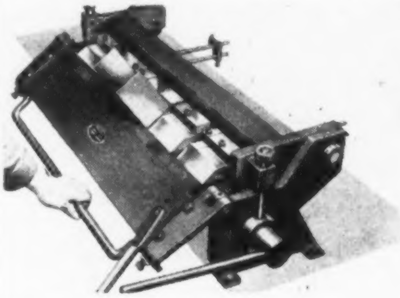


Joint drilling head

Universal joint drilling head is adjustable to any pattern of holes and is available with 4 to 12 spindles. The head features all aluminum housing construction, thrust bearings and gears turned on spindles. Available in two sizes: No. 0, 0 to 1/4 in., full range of collets furnished; No. 1, 3/16 to 1/2 in., No. 1 Morse Taper socket or chucks for straight shank drills. *Errington Mechanical Laboratories, Inc.*

For more data circle No. 32 on postcard, p. 225.



Bending brake

A hand-operated, universal, box and pan brake is designed to be mounted on a work bench for greatest convenience and operating ease. With a capacity for any bending operation on sheet metal up to 18 gage and 24 in. long, it is suited for model and experimental shops. Bending edge is made up of fingers in graduated widths fitted to a bar. Fingers are easily adjusted or removed as the work requires. They can be used in any combination anywhere along the bending edge for folding, box and pan work, and straight bending operations. *Dress & Krump Mfg. Co.*

For more data circle No. 33 on postcard, p. 225.
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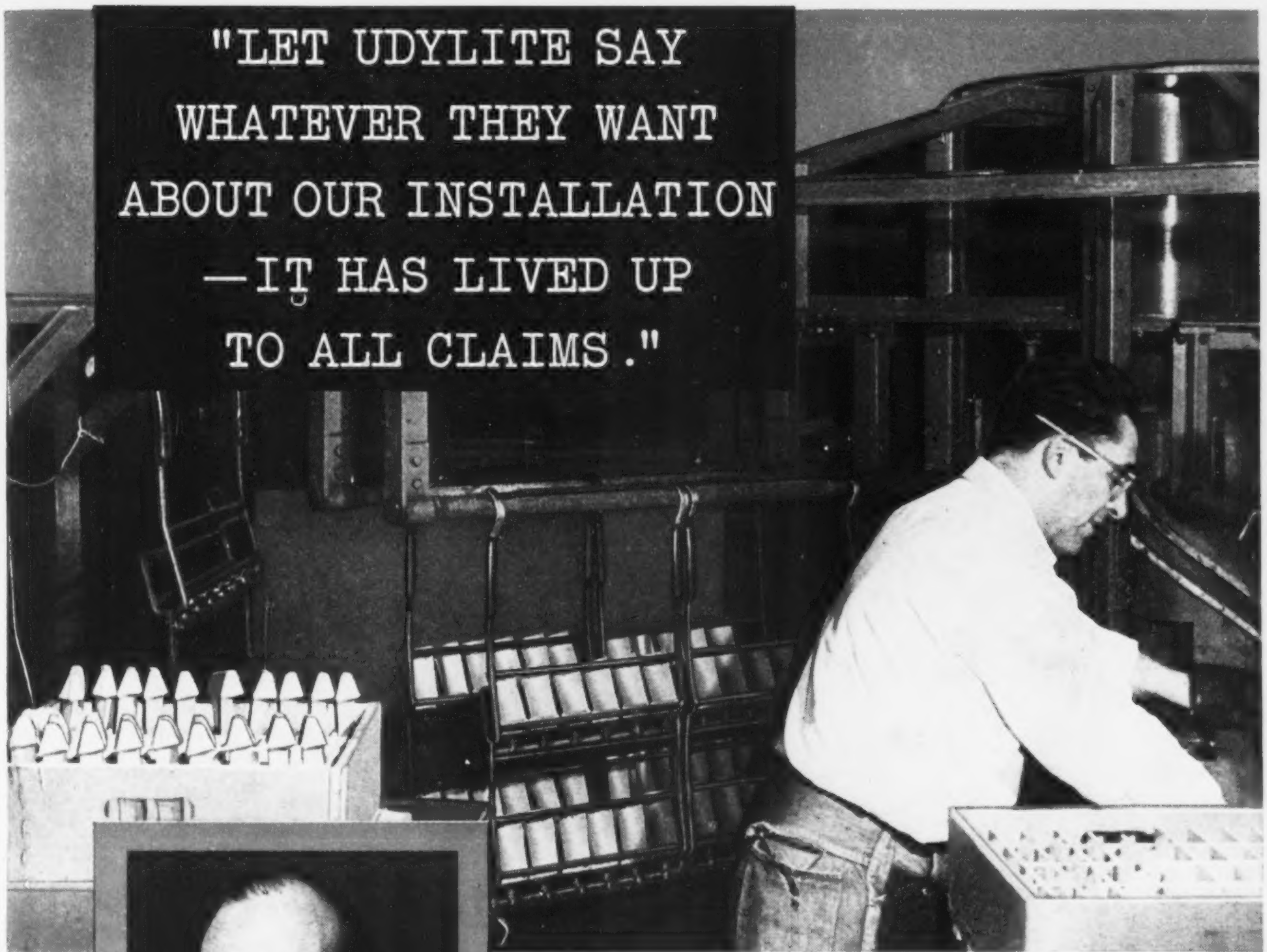

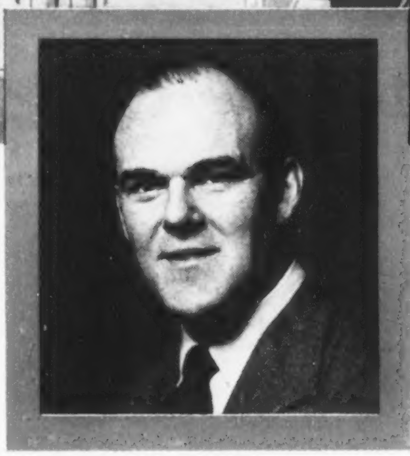

LEW WENGERT

Says Lew Wengert, Plant Superintendent of Utica Drop Forge & Tool Corporation

That was the reply we got when we asked Mr. Wengert, superintendent of the Yorkville plant of the Utica Drop Forge & Tool Corporation, about the Udylite Rotary Full Automatic in that plant. The machine is used for processing jet engine parts.

Mr. Wengert's enthusiasm is typical of Udylite customers. He has found, like many other users, that Udylite lives up to the claims made by our salesmen. The Udylite organization owes its progress and growth to the guiding principle of being honest with its customers. So, if you're in the market for equipment and supplies for a "better way in plating", it will pay you to look to Udylite. Call in your Udylite Technical Man today and let him tell you the complete story. Or write to The Udylite Corporation, Detroit 11, Michigan. *There's no obligation.*

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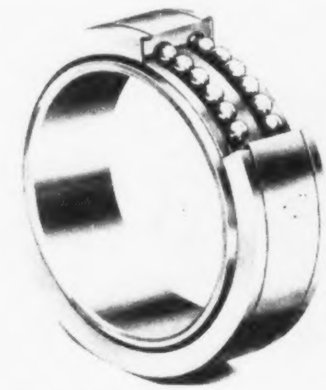
PIONEER OF A BETTER WAY IN PLATING

Ball bearing bushing

A new ball bearing bushing type DR-L for applications where space is limited features a split outer race which permits introduction of a full complement of balls. A section height of 0.250 is said to open



a new field for anti-friction performance. Prelubricated at the factory, these bearings give extended service without need for regreasing. Outer race is ground to close tolerance for press fit. Bore is available in two types adapted to press or slip fitting. Both types will carry thrust and radial load. *Split Ballbearing Corp.*

For more data circle No. 34 on postcard, p. 225.

Cutting attachment

New cutting attachment that cuts steel and other metals up to 8 in. thick fits on the Linde W-202 and W-201 welding blowpipes in place of the usual welding heads. It is intended for intermittent cutting on general, run-of-shop jobs. Twenty-three oxyacetylene cutting nozzles are available for all types of cutting. *Linde Air Products Co.*

For more data circle No. 35 on postcard, p. 225.

Dual-purpose container

Rubber hose is being shipped in a double-duty corrugated container. In addition to being a basic shipping container which protects the hose, the unit functions as a dispenser. Hose can be uncurled and pulled out through an opening in the center of the lid. A measuring rule printed on the sides and holes of the container shows how much unused hose is left. *Gaylord Container Corp.*

For more data circle No. 36 on postcard, p. 225.


HERE ARE SOME APPLICATIONS
WHERE SANDVIK STEELS
ARE STAR PERFORMERS
To find out more about SANDVIK Specialty Steels . . .
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The Iron Age

SALUTES

Dr. John Chipman

One of the world's most outstanding metallurgists, his career has been marked by achievement and acclaim.

FORTUNATELY, the evaluation of Dr. John Chipman's career as a metallurgist will not be left to historians. His contemporaries have already acknowledged his genius.

Called by many "the father of modern metallurgical thermodynamics," he has been singled out for an astonishing number of honors during his brilliant 32-year career. Next week he steps down as president of the American Society for Metals, but another honor replaces the one he relinquishes when the ASM awards him one of its highest marks of respect, the Albert Sauveur Achievement Award, offered in recognition of his contributions to metallurgical knowledge.

American scientists and engineers are not alone in appreciating Dr. Chipman's talents, however. Less than 3 weeks ago, the Italian Metallurgical Society awards him one of its highest marks of respect, the Albert Sauveur Achievement research.

It is no surprise, therefore, to find that 55-year-old Dr. Chipman has been head of the Dept. of Metallurgy at Massachusetts Institute of Technology for the last 6 years. He is exceptionally well-equipped for this responsible position. For in addition to his vast teaching experience at many of the top engineering schools in the country, he has done research work in industry and has directed phases of atom bomb studies for the Army.

Perhaps as a carryover from his early days as a chemistry professor, Dr. Chipman has also achieved a more temporal fame among the MIT faculty for his tasty mint juleps. An outdoor man, he spends many of his leisure hours landscaping the grounds around his home at Winchester, Mass.

The Iron Age

INTRODUCES

Howard T. Brinton, elected president, Phelps Dodge Copper Products Corp., fabricating subsidiary of PHELPS DODGE CORP., Elizabeth, N. J.; W. J. Palmer, named vice-president in charge of manufacturing; and John J. Conlon, made general superintendent.

Frank A. Whittall, appointed president, CONTINENTAL CAN CO OF CANADA, Montreal. He will succeed Harry A. Rapelye, who has retired.

D. E. Moody, appointed president, Canefco, Ltd., a subsidiary of ELECTRIC FURNACE CO., Salem, Ohio; K. U. Wirtz, named vice-president; and H. E. Farintosh, made secretary-treasurer.

Carl J. Snyder, Robert W. Conder, and James Cope, all appointed vice-presidents, CHRYSLER CORP., Detroit.

Stephen T. Orr, made a vice-presidet of the president's staff, WYANDOTTE CHEMICALS CORP., Wyandotte, Mich.; and Frank Wolcott, becomes general manager of manufacturing, Michigan Alkali Div.

John Hellstrom, vice-president, AMERICAN AIR FILTER CO., Louisville, Ky., appointed director of sales.

Charles E. Mertler, appointed vice-president in charge of engineering and development, STEVENS MFG. CO., INC., Mansfield, Ohio.

J. T. Butler, named chief tool engineer, TEMCO AIRCRAFT CORP., Dallas.

J. Thad Watters, made works manager of bauxite operations, ALCOA MINING CO., Bauxite, Kansas. He succeeds Luther R. Branting, who has retired after 32 yrs with the company.

Lewis C. Ely, appointed industrial sales engineer, Southeastern states, THE PARKER APPLIANCE CO.

Felix W. Saco, appointed mechanical development engineer, THE PERMUTIT CO., New York.

Eric Ledin, appointed group engineer for cockpit design, ENGINEERING & RESEARCH CORP., Flightronic Flight Simulator Div., Riverdale, Maryland.

Sam R. Read, named staff engineer, VISI-TROL ENGINEERING CO., Detroit.

J. J. Barker, appointed head, Process Dept., WALTER KIDDE NUCLEAR LABORATORIES, New York.

Martin A. Edwards, named manager of engineering, X-Ray Dept., GENERAL ELECTRIC CO., Schenectady; and Thomas F. Garahan, appointed manager of manufacturing personnel services section.

R. Kenneth Plumb, appointed manager, slag sales, U. S. STEEL CO., Pittsburgh; and Edgar B. Speer, named division superintendent of steel production, Gary Works.

Denton Massey, named general manager of European operations, WILLYS-OVERLAND EXPORT CORP., Toledo.

Richard H. Gannon, named manager of sales office, Los Angeles district, KAISER ALUMINUM & CHEMICAL SALES. INC.

Otto Janssen, appointed manager, spare parts sales. AIRESEARCH MFG. CO., Los Angeles.

James K. Hoyt, appointed assistant western manager, A. MILNER & CO.; and William P. Cooney, named sales representative, Philadelphia district.

G. H. TEICHERT, appointed president and a member of the board of directors, Alloy Steels, Inc.

HERBERT J. WATT, named assistant vice-president-sales, western area, U. S. Steel Co., Pittsburgh.

F. ROYAL GAMMON, appointed assistant vice-president-sales, eastern area, U. S. Steel Co., Pittsburgh.

Gordon M. Williams, appointed assistant supervisor, agricultural chemicals research section, PITTSBURGH COKE & CHEMICAL CO., Pittsburgh.

C. B. Foster, appointed to newly created position of sales manager-engines, CUMMINS ENGINE CO., INC., Columbus.

Thomas F. MacLaren, appointed representative, Los Angeles office, BROWN & SHARPE MFG. CO., Providence; and **Frank K. Wilkey,** named representative in Los Angeles.

Raymond Dearth, becomes sales engineer, Northern Indiana area, THE UDYLITE CORP.

Irving R. Taylor, appointed assistant manager, Warren Machine & Die Div., THE AMERICAN WELDING & MFG. CO., Warren, Ohio.

N. C. Hays, made west central district manager, DAVEY COMPRESSOR CO., Kent, Ohio.

Peter R. Prunkl, appointed plant manager, TUBE REDUCING CORP., Wallington, N. J.

P. F. Marsaw, named personnel manager, REED ROLLED THREAD DIE CO., Worcester, Mass.

Ray C. Wright, promoted to sales manager, STRONGHOLD PACIFIC CORP., Los Angeles.

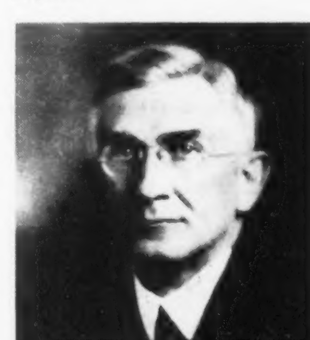
Leland E. Coulter, named general manager, R-B interchangeable punch and die activities, Hillsdale, Mich., plant, ALLIED PRODUCTS CORP.

William M. Taylor, named manager, Export Dept., Quaker Rubber Corp., a division of H. K. PORTER CO., INC., Philadelphia.

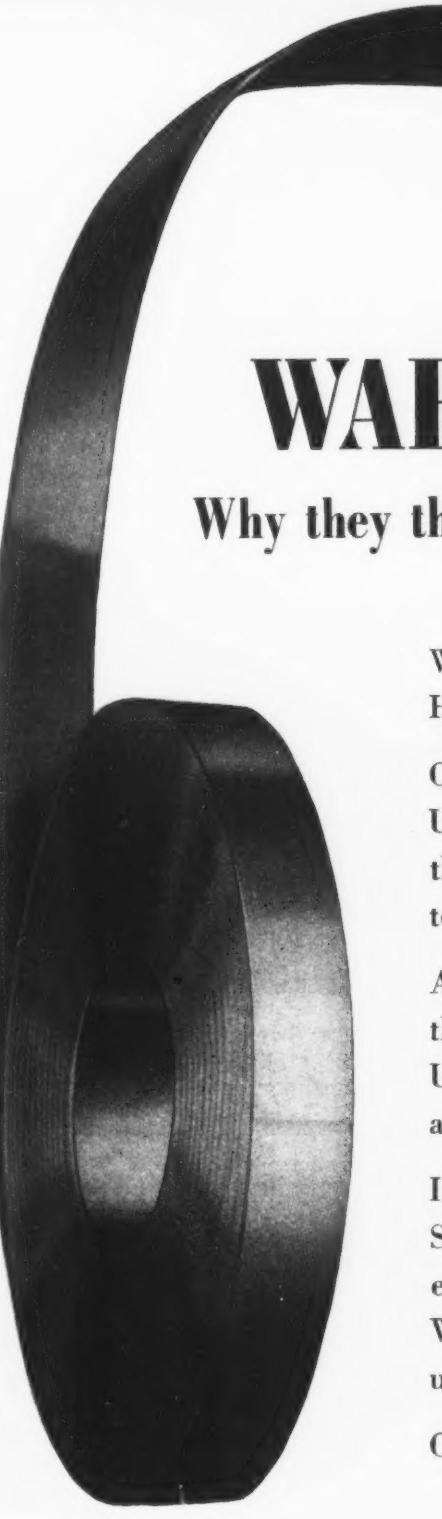
F. C. MESSAROS, named vice-president in charge of engineering, American Engineering Co., Philadelphia.

CHARLES T. ZAORAL, becomes vice-president in charge of operations, New York Air Brake Co.

H. PAGELS, appointed vice-president in charge of manufacturing, American Engineering Co., Philadelphia.



LEWIS K. SILLOX, elected vice-chairman of the board, New York Air Brake Co.



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—Personnel—
Continued

R. H. Filsinger, Jr., appointed district manager, Pittsburgh area, VANADIUM CORP. OF AMERICA. He succeeds **John B. Girdler,** appointed sales manager.

Henry W. Becker, named assistant director of industrial relations, specializing in labor relations, REPUBLIC STEEL CORP., Cleveland.

J. T. Maidens, appointed manager, Philadelphia territory, MORSE TWIST DRILL & MACHINE CO. He will be assisted by **William Rogers.**

Jerry G. Wilson, named engine sales supervisor, Sales Development Div., CATERPILLAR TRACTOR CO., Peoria, Ill.

Clifton P. Brown, appointed assistant manager, Fastener Div., in Nashua, New Hampshire, EDGCOMB STEEL OF NEW ENGLAND, INC.

J. D. Bryan, Jr., appointed sales promotion manager, PEDEN IRON & STEEL CO., Houston, Texas.

Ernest R. Johnson, appointed district manager, Central Alloy district, REPUBLIC STEEL CORP., Cleveland, Ohio.

•

John Longden, named district manager, Salt Lake City office, NATIONAL ELECTRIC PRODUCTS CORP.

Harry T. Brunstetter, appointed superintendent, Silicon Strip Dept., REPUBLIC STEEL CORP., Warren District steel plant; **William E. Schnitgen** becomes assistant superintendent of the Dept.; and **P. R. Cleary,** promoted to lubrication engineer,

A. N. Mason, appointed sales representative and **John K. Gillett,** also appointed sales representative, Metropolitan New York, and northern New Jersey, MICHIGAN OVEN CO.

OBITUARIES

D. F. Hahn, 52, vice-president, production manager, and a director of General Box Co., suddenly.

Clarence Earl Bleicher, 62, president and general manager of De Soto Div., Chrysler Corp., at Henry Ford Hospital in Detroit.

Frederick L. Curtis, 84, retired vice-president of Raybestos - Manhattan, Inc., and former general manager of Manhattan Rubber Div., at his home.

Record Attendance Predicted for Metalworking's Biggest Show

FROM Oct. 20 to 24 Philadelphia will play host to what sponsors and exhibitors expect will be the biggest Metal Show ever. Technical sessions will be held in downtown hotels; the exhibits will be housed under a single roof on 210,000 sq ft of space in Convention Hall. To ease the strain on tired feet, the aisles of the exhibit halls will be covered with some 1.5 miles of carpet with a foam rubber backing.

This year's show will put more emphasis on "hard selling," more exhibits, more practical demonstrations. For effort, attendance and worthwhile ideas, no metalworking meeting tops this exposition and its technical sessions. Somewhere among the hundreds of technical papers, seminars and symposiums there will be valuable ideas for the metalworking executive. And among the 400 exhibits he is bound to see new ideas and new products to help him cut costs—or at least hold them in line.

The Congress (technical papers, etc.), begins on Saturday, Oct. 18 and continues through Friday, Oct. 24. For details see the technical program which starts on the following page.

The Exposition will be held in Convention Hall (34th St. & Curie Ave., about a mile and a half from downtown hotels) from Monday, Oct. 20 through Friday, Oct. 24. It will be open on Monday, Tuesday and Wednesday from noon until 10:30 p.m. On Thursday and Friday the hours are 10:00 a.m. to 6:00 p.m.

For a listing of Metal Show exhibitors, with booth numbers see p. 328.

TECHNICAL PROGRAM
NATIONAL METAL CONGRESS

Philadelphia, October 18-24

The technical meetings of the four sponsoring societies will be held in these downtown Philadelphia hotels:

American Society for Metals	Hotel Benjamin Franklin
American Welding Society	Bellevue-Stratford Hotel
Institute of Metals Div., American Institute of Mining & Metallurgical Engineers	Hotel Adelphia
Society for Non-Destructive Testing	Hotel Sylvania

AMERICAN SOCIETY FOR METALS

Monday, Oct. 20, 9:30 a.m.

HIGH TEMPERATURE PHASES

Microconstituents in High Temperature Alloys — H. J. Beattie, Jr., physicist, and F. L. VerSnyder, metallurgist, General Electric Co., Thomson Laboratory, West Lynn, Mass.

Sigma Formation and Its Effect on the Impact Properties of Iron-Nickel Chromium Alloys — A. M. Talbot and D. E. Furman, Research Laboratory, International Nickel Co., Inc., Bayonne, N. J.

Mechanism of the Carburization of Some Stainless Steels—J. B. Giacobbe, metallurgist, Superior Tube Co., Norristown, Pa.

The Electrolytic Separation and Some Properties of Austenite and Sigma in 18-8-3-1 Chromium-Nickel-Molybdenum-Titanium Steel — T. P. Hoar, Dept. of Met., University of Cambridge, England, and K. W. J. Bowen, Research Dept., Imperial Chemical Industries, Birmingham, England.

Monday, Oct. 20, 2:00 p.m.

CREEP RUPTURE AND RECRYSTALLATION

Creep-Rupture and Recrystallization of Monel from 700-1700° F.—N. J. Grant, associate professor, and A. G. Bucklin, staff member, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

Influence of Grain Size on High Temperature Properties of Monel—Paul Shahinian and J. R. Lane, members of the Metallurgical Division, Naval Research Laboratory, Washington, D. C.

Creep and Rupture of Chromium-Nickel Austenitic Stainless Steels —E. J. Dulis, G. V. Smith and E. G. Houston, Research Laboratory, United States Steel Co., Kearny, N. J.

Recrystallization and Grain Growth in Alpha Brass — S. L. Channon, Kaiser Aluminum and Chemical Corp., Spokane, Wash., and H. L. Walker, Head, Department of Mining and Metallurgical Engineering, University of Illinois, Urbana, Ill.

Tuesday, Oct. 21, 9:30 a.m.

PHASE TRANSFORMATION

The Effect of Composition on the Temperature of Spontaneous Transformation of Austenite to Martensite in 18-8 Type Stainless Steel—G. H. Eichelman, metallurgist, American Brass Co., Waterbury, Conn., and F. C. Hull, manager, Metallurgical Section, Westinghouse Electric Corp., E. Pittsburgh.

The Effect of Silicon on the Tempering of Martensite—A. G. Allten and P. Payson, assistant director of research, Crucible Steel Company of America, Harrison, N. J.

The Mechanism and Kinetics of the First Stage of Tempering—C. S. Roberts, Metallurgical Laboratories, Dow Chemical Co., Midland, Mich., B. L. Averbach, assistant professor and M. Cohen, professor of physical metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

The Order Disorder Transformation Viewed as a Classical Phase Change—F. N. Rhines, professor of metallurgy, and J. B. Newkirk, Carnegie Institute of Technology, Pittsburgh.

Tuesday, Oct. 21, 2:00 p.m.

HARDENABILITY

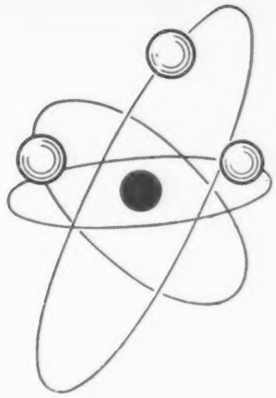
An End-Quench Test for Determining the Hardenability of Carburized Steels — F. X. Kayser, research metallurgist, and R. F. Thomson, head, Metallurgy Department, Research Laboratories Div., General Motors Corp., Detroit.

The Influence of Boron on Case Hardenability in Alloy Carburizing Steels — C. F. Jatczak, research metallurgist and E. S. Rowland, chief metallurgacil engineer, Timken Roller Bearing Co., Canton, Ohio.

Turn to Page 356

ASM SEMINAR

This year's seminar will be on "Modern Research Techniques in Physical Metallurgy." It will be held on Oct. 20 and 21, morning sessions at 9:30; afternoons at 2:00 in the Benjamin Franklin. It will cover: Metallographic, diffraction, mechanical, ferromagnetic and radioactive methods.



Metals For Tomorrow

Except for their use in some cases as alloying elements these metals were little known just a few years ago. Today, because of their availibility in the free world and because of research into their properties and use they promise to become the metals of tomorrow. At the moment, many of them are either difficult or expensive to produce in usable form. In some cases demand exceeds the supply available in refined form; in others the supply potential is good but more study of the characteristics of the metal and their possible uses is needed.

What is their availability; what are their properties and prospects; where can they be obtained and at what price? This report is designed to answer these questions for the metalworking executive and the metallurgist, for researchers and government officials; for all, in short, who realize that the promise of technology is the hope for the future.

Of course there is no suggestion that the wider use of the "uncommon" metals will be at the expense of the bread and butter metals of today. Aluminum, magnesium, iron and steel will continue to expand tremendously in the years ahead.

These articles, except titanium, are based in part on sections of the Report of The President's Materials Policy Commission.* The sections selected from this report—Cerium, Germanium, Lithium, Selenium, Molybdenum, Vanadium, Silicon and Zirconium—were compiled by the Battelle Memorial Institute, Columbus, Ohio, in August, 1951 and have been completely revised for this issue by the Battelle staff, which has also contributed valuable advice on the first article, titanium.

**Resources for Freedom, Vol. IV, The Promise of Technology,* U. S. Government Printing Office, June 1952.

MAJOR SPONGE producing locations in the United States.

Titanium

our No. 1 problem metal

D. I. Brown
Technical Editor
THE IRON AGE

Part I

Perplexing engineering and commercial problems confront our new budding industry. All the glamour is gone—having been replaced by stark realism of metal production and use. Hundreds of test applications are being tried but few actual parts are in production. The titanium parts in jet engines are still on the ground—none have yet flown. Fabricating methods are being perfected but welding, particularly of the titanium alloys still presents a major problem because of low ductility. Titanium is still a war baby and government pressure for more capacity will continue. Although at the moment there is an oversupply of sponge, one good sized production order could deplete our stockpile of sponge.

All the glamor has worn off titanium. Today the metal is tarnished with a host of confusing problems all the way from sponge making to eventual use as a fabricated part. The technical and engineering problems, while difficult are no more perplexing than the commercial problems.

Commercially the chief wonder left in our "Wonder Metal" is that the producers wonder when they will get some real orders; the users wonder when they will get deliveries of orders placed months ago; the government wonders how long they can continue to say that there is a shortage of sponge when their stockpile of sponge continues to increase and everybody is wondering who will come up with what kind of a new process which will antiquate the Kroll method and/or cut the present high price of the metal.

The attempt to cram into a few years the huge development of an entirely new metal industry which would ordinarily take a decade to accomplish, is mostly responsible for all the present paradoxes. In the order mentioned; the producers problems are three fold: (1) better quality of the metal, which in 2 years has improved tremendously, (2) more and larger orders to perfect their manufacturing processes and establish a rational flow of business based on repeat orders not test lots and (3) on which of the many possible types of titanium alloys should they con-

centrate their efforts.

The consumer's three major problems are: (1) how to justify on an economic basis the application of a metal that costs at least 10 to 50 times that of present materials, (2) how to adopt present fabricating techniques and develop new methods to be able to actually make titanium parts on a production basis, (3) when will the metal be readily available in large enough quantity and consistent enough quality to work out items (1) and (2).

The government is strictly in the middle, having to step in last October through Defense Materials Procurement Agency and subsidize sponge production else the chief supplier quit production for lack of a market. Prior to that, in April 1951 Ordnance Corps had resuscitated the metal producers by placing orders for 62½ tons of titanium in various forms which was used for test purposes in their large scale research program. Table I shows approximately how much money the government has invested to date in our war baby, titanium.

The major problems still facing government are: (1) How much more money shall they set aside to keep the Kroll process going when private industry refuses to invest in this process but is spending millions to find a new titanium production method. (2) Based on tests and use to date what should the titanium production or consumption target be 2, 3 or 4 years hence. See Table II. (3) Should they advance more help and money to consumers of the metal and (4) which comes first the chicken or the egg, i.e., (1) or (3).

Present high cost big drawback

None of these problems are straightforward. Conditions vital to each problem are changing constantly. Back of all of them are engineering and technological peaks yet to be assailed before the logical goal can even be sighted.

The present high cost of the metal is basic to all our present problems. If it were not the length of the tenure of the Kroll process would not be in question and all our efforts would be centered around making this production process continuous, more economical to run, etc. Table III shows the annual sponge production. Sponge production is not synonymous with metal production. The actual ingot tonnage melted from the sponge produced to date is not known.

The making of titanium is much more closely allied to our chemical industries than that of our other major metals. The companies now in basic metal production are shown in Table IV. From the list of those searching for new methods, Table V, it would appear that titanium production will continue to be closely associated with our chemical industries for some time. A truly continuous electrowinning process offers as

TABLE I

FEDERAL GOVERNMENT'S INVESTMENT

New sponge plant to be built by Dupont	$14,700,000
Rebuild Henderson Nev. Plant to make sponge, Titanium Metals Corp.	15,000,000
Fund to stockpile sponge until demand catches up with supply—DMPA	5,000,000
Research Programs led by various agencies like Ordnance Corps Air Force U. S. Navy Bur. of Ships, Bur. of Air, etc.	15,000,000*
	$49,700,000

*Estimated.

TABLE II

ESTIMATED SPONGE REQUIREMENT*

1952	15,000 tons
1953	20,000 tons
1954	22 25,000 tons

* At the moment there is an oversupply of sponge.

TABLE III

ANNUAL SPONGE PRODUCTION NET TONS

1949	negligible
1950	60 tons
1951	495 tons
1952 (first 6 months) (est. for year)	500 tons 1500 tons

TABLE IV

SPONGE PRODUCERS AND NEW CAPACITIES

Company	Present Production on Annual Rate	Planned Capacity tons per year	Location
Dupont	900 tons	3600 by 1954	Newport & Edgemoor, Del.
Titanium Metals Corp.	550 tons	3600 by ?	Henderson, Nev.
U. S. Bureau of Mines	.....	360 this year	Boulder City, Nev.
Crane Co.	9 tons	21 this year	Chicago, Ill.

many or more engineering problems than that of the present batch type magnesium reduction process which, in both cases, only the chemical industry, or more precisely the pigments industry, has previous experience, similar equipment and trained personnel.

The fact that one large organization gave up research on electrowinning methods and is again looking at a method not unlike the old iodide method in the hope of making massive metal cheaper merely emphasizes the fact that probably no new process will appear soon to replace that perfected by Dr. Kroll of the U. S. Bureau of Mines in 1946. A schematic outline of the modified magnesium reduction process representative of present sponge making practice is shown in Fig. 1, next page.

(Text Continued on Page 264)

MODIFIED MAGNESIUM REDUCTION

A

The rutile is compressed into briquettes. This charge material is dumped into the 25-ft high retort shown schematically below. Chlorine from the Magnesium cells plus a certain amount of makeup chlorine is piped into the retort where the titanium tetrachloride is made. These retorts operate at 800 C. Heat is supplied by 6 electrodes in the bottom of the refractory lined retort. The electrodes are covered with a bed of graphite. The resistance of the graphite bed to the current furnishes the necessary heat. Power requirements are not high, being estimated at close to 1 KWH per lb of titanium tetrachloride produced.

The vapors formed in the retort are piped out of the top of the vessel through an 8" diam pipe. These vapors are condensed and purified into a heavy colorless liquid titanium tetrachloride which looks like water, and stored for use as needed.

Heavy walled stainless steel retorts of the shape shown are used for the magnesium reduction step in the process. The half cylinders are bolted together through a flange at the center as indicated, and crimped stainless steel strip has been used as gaskets in this joint. These joints must be air tight to maintain the inert atmosphere inside the retort. The 1½ in. wall stainless vessels cost about $8000 each. Some trouble has been experienced with magnesium corroding the stainless vessels. This intergranular corrosion usually takes place near the top of the retort.

B

In operation, some magnesium is placed in the bottom of the retort. The retort is then bolted together and placed into position in the balcony, where the flange serves to support the retort in an upright position. Helium gas is pumped into the retort, all the air is purged and propane gas burners are applied to the bottom of the reactor to melt the magnesium charge. Liquid titanium tetrachloride is pumped through the top of the retort at an initial rate of about 400 lb per hr.

C

The reaction starts and further heat is seldom needed as the reaction, $2Mg + TiCl_4 \rightarrow 2MgCl_2 + Ti$ is highly exothermic. As the reaction progresses, additional Mg is added through the top of the retort through a double trap door as indicated. This arrangement permits charging without admitting air. This Mg is added as solid 2-in. diam bars 12-in. long which are surface ground to remove any oxide formed by weathering. The solid Mg is immediately melted by the heat already in the retort.

Due to the capillary action of the Mg, which causes it to creep up the side of the retort, and because the sponge forms in vertical planes, the big mass of sponge forms in the top half of the retort. The by-product of the reaction, $MgCl_2$, runs down from the sponge and collects in the bottom of the retort.

The complete reduction cycle takes 3 to 4 days during which time about 7700 lb of TiC_4 plus about 2000 lb of Mg is charged. This produces from 1900 to 2000 lb of sponge when the reaction is finally stopped. During the cycle the $MgCl_2$ is kept molten by the gas burners, if necessary, and

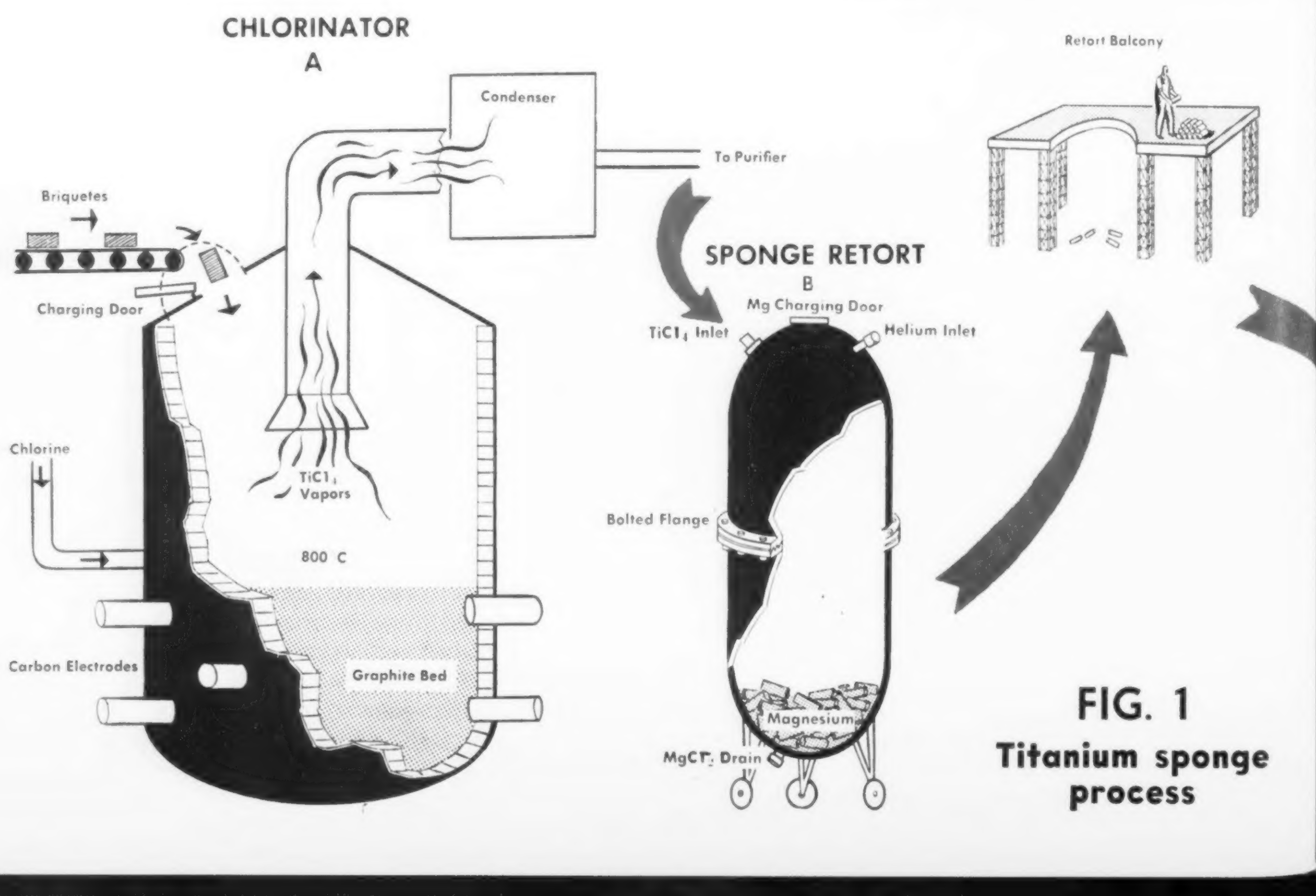


FIG. 1
Titanium sponge process

PROCESS FOR TITANIUM

this liquid, $MgCl_2$, is periodically drained off.

The sponge contains 99.5 pct Ti plus entrapped $MgCl_2$ plus any impurities that might have been present in the $TiCl_4$ or of the Mg. When the reduction is completed the helium gas is bled off and vacuum pumps are hooked into a line at the top of the retort prior to starting the distillation process. The sponge must be distilled as $MgCl_2$ and traces of Mg metal and lower titanium chloride are mixed into the sponge.

D

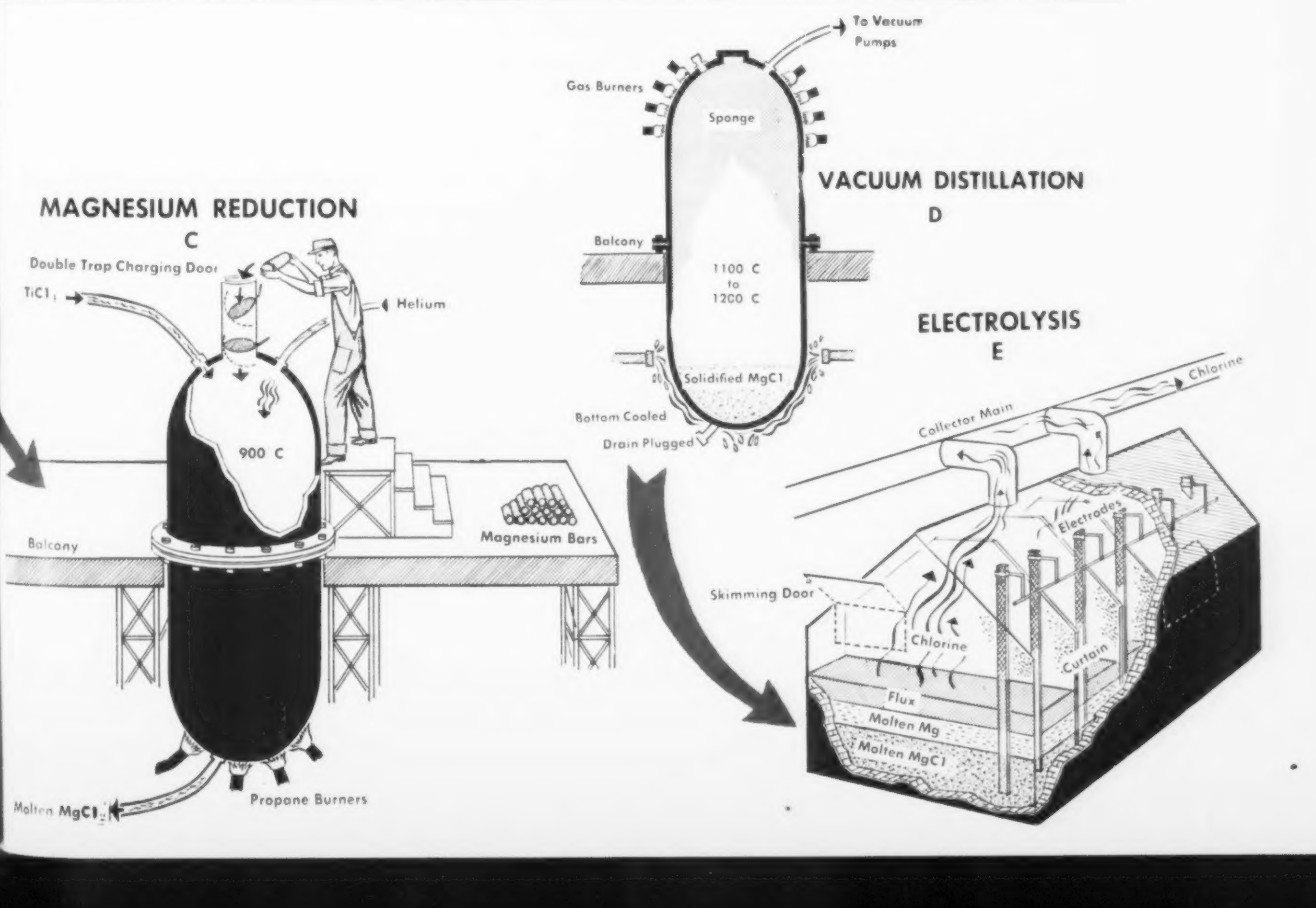
The vacuum distillation process can be run at a variety of temperatures and times. The temperatures necessary to melt the Mg salts depends on the vacuum pressure. At a pressure equal to 10 mm of mercury, the temperatures should run 1100 to 1200°C for a decent time cycle and good purity sponge.

In this operation, shown schematically, the top half of the evacuated retort is gas heated and the lower half is cooled to condense and solidify the $MgCl_2$ that runs down into the lower half of the retort. Because of this method of distillation, the walls of the retort must be thick to support the pressure exerted on the retort else it would collapse.

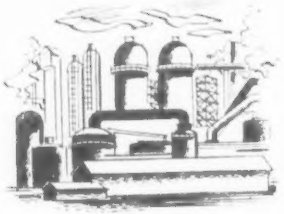
After the distillation cycle is complete, the retort is cooled. The retort halves are then unbolted and the top containing the sponge is protected from the air and taken to a large boring mill or lathe. Here the sponge is drilled out of the retort with diamond drills and crushed and sized for further melting. Care is taken to prevent oxidation of the sponge during machining. Air is excluded from fresh sponge as much as possible and crushing is usually done under controlled humidity conditions. In machining the sponge from the retort about 1 to 1½ in. of hard sponge is left in the steel shell. This helps prevent contamination and corrosion of the retort walls in subsequent runs.

E

The lower half of the reduction retort containing exceptionally pure $MgCl_2$ is then emptied and the $MgCl_2$ is charged into the Mg cells, diagrammed. These cells operate on about 8.3 v per cell. There are 44 cells, which require a total electrical energy of 365 v at 20,000 amps. Six sets of electrodes, cast iron cathode and graphite anodes make up one cell. Ceramic curtains separate the electrodes so that each cell contains 5 curtains. The $MgCl_2$ is charged on the bottom and a flux is added. The molten Mg separates out in a bath on top of the electrolized, now molten, $MgCl_2$. The Mg is skimmed off and cooled and is later purified and recharged into the reduction retorts. Mg recovery is good and the chlorine gas raises through the flux and is taken off through 2 cast iron pipes into a main collector pipe system. There are 2 collector pipes to each cell. The chlorine mains collect the gas from all cells and deliver the gas to filters. Gas recovery is not 100 pct and makeup chlorine, must be added along with the cell gas to the reduction retort. The power consumption of these Mg cells run about 9 KWH per lb of Mg produced, which is not much more than that used in the Dow type cell.



Experimental Titanium Applications



This article will start with test applications of titanium and the fabrication methods. Sponge making, melting and casting problems as well as an evaluation of some research programs will be discussed in detail next week in Part II of this article.

A quick recap of the status of titanium in the major fields of application is necessary in order to intelligently assess the present position of the metal. Too much early enthusiasm and ill considered statements have confused the industry. Actual supply and demand conditions have most often been cast aside by those who prefer to think of the tremendous future market potentials of the metal.

TABLE V

TITANIUM SWEEPSTAKES

Companies	
Monsanto Chemical Co. & National Research Corp.	
Dow Chemical Co.	WIN
Dupont	
National Lead Co.	
Horizons, Inc. } Ferro, Corp.	PLACE
Kennicott Copper Co.	
American Cyanimid Co.	or
Chicago Development Corp.	
Glidden Co. & Bohn Aluminum Corp.	
Metal Hydrides Corp.	SHOW
Union Carbide & Carbon Corp.	

Supplies of titanium in product form from the producers shown in Table VI are adequate to meet today's demands for unalloyed metal. Supplies of alloys for forgings are also adequate, but deliveries of alloys in sheet form remain extended. Wire and tubing are hard to get. There is a surplus of sponge as well as a surplus of melting capacity but there is a general shortage of orders. Despite the repeated predictions of new processes which will greatly lower the present prices, no actual process has yet appeared to substantiate these claims. This does not mean that metal produced by magnesium reduction won't continue to decrease slowly.

Titanium is inherently an aircraft material because of its relatively high strength weight ratio. This characteristic is particularly valuable in reciprocating parts. Unalloyed titanium, however, does not compete with aluminum or magnesium in most aircraft applications unless temperatures of over 200° to 300°F are involved. The one exception to this general rule at present is fuming nitric tanks. Here titanium is a justifiable substitute for aluminum if the tank must function above 120°F for extended periods.

Commercial purity titanium does offer attractive weight savings when used to replace 18-8 stainless. In these cases the required strength levels are usually around 35,000 psi min. Y.S. In the alloy grades of titanium also there are many more cases where the metal will replace aluminum and stainless because of the higher strength weight ratio characteristics of the

TABLE VI

SUPPLIERS OF TITANIUM MILL PRODUCTS

	Bars	Billets	Plate[1]	Sheet	Strip	Rod	Wire[2]	Alloy Designations
Rem Cru Titanium, Inc. Unalloyed	√	√	—	√	√	√	√	RC 130A,
Alloys	√	√	√	√	—	√	√	RC 130B
Titanium Metals Corp. Unalloyed	√	√	—	√	√	√	√	Ti 150A, Ti 150B,
Alloys	√	√	√	√	√	√	√	Ti 140A[4], Ti 175A[3]
Mallory Sharon Titanium Corp. Unalloyed	√	—	—	√	√	√	—	MST 3A1-5Cr,
Alloy	√	√	—	—	—	√	—	2.5 Fe-2.5V 2A1-2Fe
Republic Steel Co. Unalloyed	√	√	√	√	√	√	√	RS 110,
Alloy	√	√	√	√	√	√	√	RS 120

Welded and cold drawn tubing available from Superior Tube Co., Norristown, Pa., and Trent Tube Co., East Troy, Wis., Subsidiary Crucible Steel Co. of America. Tubing available in unalloyed grades only.

[1] Anything above 3/16 in. thick.

[2] Smallest diam. in alloy wire 0.100 in.

[3] Temporarily off the market.

[4] New alloy 1.5 to 2.5 Fe, Cr & Mo 0.05 C Max. 0.08 N_2 Max.

TABLE VII

POSSIBLE MILITARY AIRCRAFT APPLICATIONS

Parts requiring 80,000 to 100,000 psi U. S. Unalloyed Titanium

Application	Weight Required per Airplane—lbs	Approx. Weight Saving per Airplane—lbs
Nacelle area (firewalls, tail cones, fairing, cowling, etc.)	682	230
Hydraulic tubing[1]	127	43
Pneumatic system[1]	1875	625
Nacelle area (firewalls, tail cones, fairing, cowling, etc.)	610	380
Anti icing (ducts)[1]	....	....
Nacelle area	435	145
Shroud	75	21½
Firewalls, dowling, ducts, fairings	....	1072
Firewalls, cowling, ducts, fairings	....	989
Firewall, nacelle fittings	65	25
Bulkhead	50	20
Bulkhead	37.5	15
Substitution for annealed stainless steel sheet	270-1100	200-800
Shrouds, firewalls, etc.	20	14
Fire and radiation shields	40	28
Armament	600	300
Shrouds, fire and radiation shields	195	90
Shrouds, fire and radiation shields	400	280
Firewalls, shrouds, misc. power plant items now stainless steel	....	100
Outer tail pipe, firewalls, air ducts and ammunition boxes (these items now stainless)	....	142
Fuselage sheet metal parts such as shrouds, firewalls, etc.	....	65
" " "	....	8
" " "	....	65
" " "	....	34
" " "	....	23
Keel web, pod firewall	....	70
Ammunition boxes, ejection chutes, blast tubes, ejector cones, misc.	....	141
Ammunition boxes, wing shield	....	20
Bolts, screws	515	344

Parts Requiring 130,000 to 150,000 psi Ultimate Strength Titanium Alloys

Application	Weight Required per Airplane—lbs	Approx. Weight Saving per Airplane—lbs
Nacelle area	727	240
Landing gears	2550	850
Wing area (fittings)	525	175
Flap track and carriages	810	270
Body area (bulkhead fittings, etc.)	2060	690
Steel fasteners	2100	700
Nacelle area	690	230
Landing gears	2975	992
Wing area (fittings)	176	59
Flap tracks	286	96
Body area (fittings)	112	149
Steel fasteners	1050	350
No applications foreseen with present designs	....	....
Primary and secondary structure	....	669
Primary structure	....	293
Bulkhead	87.5	35
Fasteners in general, bolts, screws, nuts, hi-shear rivets	2376	1470
Fasteners in general, bolts, screws, nuts, hi-shear rivets and some sheet applications	792 (bar) 500 (sheet)	800-900
Substitution for annealed and 1/ H stainless steel	270-1300	200-1000
Substitution for bolts	70-270	50-200
Fittings, bolts, etc.	20	15
" " "	60	40
" " "	40	20
" " "	60	40
Small fittings now steel	....	15
Small fittings now aluminum	....	15
Hull skin	....	40
Floats	....	38
No worthwhile applications	....	Negligible
General fuselage sheet metal structure such as frames, longerons, etc.	....	65
" " "	....	29
" " "	....	26
" " "	....	510
" " "	....	21
Keel web, pod firewall	....	80
A/B Turbine pump outlet	4.6	6.8
16th stage compressor air	12.7	18.6
16th stage comp. leakage	8.0	12.0
Acceleration bleed	13.0	20.0
Engine shroud	15.0	22.0
Keel cap	109.0	81.0
Keel web	131.0	96.0
Engine burner shroud	31.7	46.6
Engine exhaust shroud	9.3	13.6
Fuselage floor shielding	45.0	66.0
Fwd fire seal	4.6	6.8
Aft fire seal	2.9	4.2
Aft exhaust web	1.2	1.6
Aft bulkhead	1.2	1.6
Slat tracks, high temp. bulkhead, etc.	....	94

Above survey made by Aircraft Industries Association.

alloys. Table VII is a summary of military aircraft parts for which titanium is being considered. The only stated requirements of titanium products like sheet, bar, plate, etc., for current and future military demands have been offered by NPA. These requirements by weight are classified but percentage breakdown of all requirements are shown in Table VIII. At the moment, it appears that about 30 pct of military aircraft requirements is unalloyed metal.

Early applications of titanium to military aircraft were instigated mostly by the aircraft companies despite the indifference or lack of concrete help from others, notably Air Force. Lately, Air Force has taken a more vital interest and has placed some important research projects, see THE IRON AGE, Aug. 7, p. 63. While Air Force was backing basic research into phase diagrams and welding problems the aircraft industry was struggling to get deliveries, and trying to fabricate poor quality material.

There is no single figure that can be used to express the premium in dollars that can justify the use of titanium in aircraft. Each part on each plane, in fact the same parts on a single plane present different economics depending on the current weight status for a given design completion. In the past, the aircraft companies have even had to double design because of the erratic supply of titanium.

The only rational method to use in approaching the use of the new metal for aircraft is to start with mission load divided by cost of the aircraft and adjust this price per lb for design completion and current weight status. As the ship nears completion and if the weight margin is tight, a premium of hundreds of dollars per lb of parts might very well be justified. Should the ship be completed well below the guaranteed weight there is no sense in shoving in light, costlier parts unless this weight advantage can be actually used in its missions. In the case of one Navy fighter, the titanium premium ranged from $20 to $52 per lb of part during one stage of design. Many of the present test applications on titanium parts are being used for engine shrouds. Fig. 2 shows the experimental engine shroud being tested which is somewhat typical for the industry.

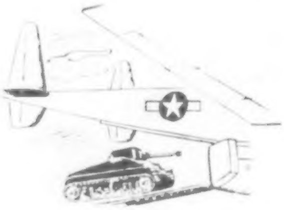
Merely saying that titanium in sheet, or bar

TABLE VIII

PRODUCTS REQUIREMENTS BY PERCENT
NPA estimate

Sheet, strip and plate	29.4 pct
Bar, rod and wire	8.7 pct
Forgings	56.8 pct
Extrusions	1.9 pct
Tubing	2.9 pct
Powder	.2 pct
Sponge	.1 pct

Ordnance leads titanium parade—



form, is worth a \$20 or \$30 or \$40 premium per lb for each lb it reduces military aircraft weight is fallacious. The costs must be compared on a *fabricated part basis* else someone lose their shirt by forgetting that welding, forming, machining, straightening, grinding, etc. (which are discussed in detail later), costs much more at the moment when working with titanium than the other aircraft metals. These fabricating costs, as well as the price of the metal, will come down but until titanium prices are more nearly competitive, see Table IX, *the cost per lb of fabricated part*—rule will hold.

The fact that titanium has been applied to one commercial aircraft, the DC-7 does not mean that the metal has arrived as a regular material in this field. Douglas Aircraft is using 1000 lbs of RC-70 Ti sheets per ship at a weight savings of 400 lb per ship. These sheets which range in thicknesses from 0.016 in. to 0.051 in. are being fabricated into engine nacelles. Titanium is being used in this plane for only two reasons, (1) The company is anxious to get experience in design, fabrication and use of the metal, (2) titanium on commercial aircraft is a fad. For these reasons other builders of commercial aircraft will follow, but based on today's mission load, ship design and price of titanium, none of these applications are economic and the use will be restricted to very small amounts.

In the case of the DC-7 the titanium sheets could only be justified economically if they could be obtained at somewhere around \$7 to \$8 per lb. Replacing steel bolts on one commercial aircraft with titanium alloy instead of 0.30 to 0.40 C alloy steel at 160,000 pss U. S. level would save 1000 lbs in the present design. Chief trouble is that hot headed bolts with rolled threads and a cold rolled shank would probably be needed, and such bolts cost a lot of money.

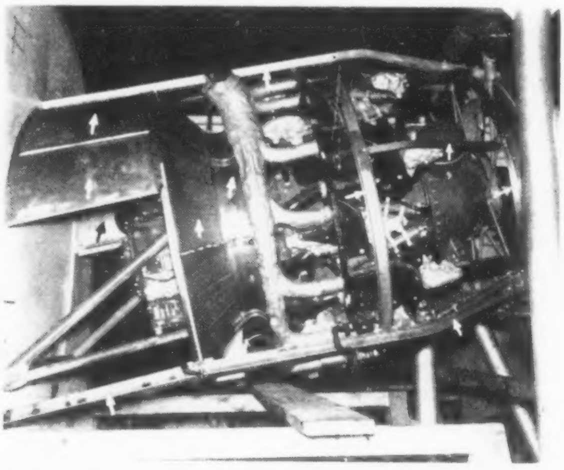


FIG. 2—Titanium engine shroud parts now under test by Piasecki Helicopter Corp. Spot welded and riveted fabrication methods are employed. All material is RC-70.

Titanium as yet is a war baby. For this reason military use has been and will continue to be the primary market until price of the metal gets down to around \$2 to \$3 per lb in product form. Commercial aircraft, therefore, does not now offer a big market. In the first place there are only 1260 total aircraft owned by all of our commercial airlines at present. All told we have 50,000 single engine non-military planes and no justifiable titanium applications have been advanced for these craft to date based on today's metal price.

Naval applications not yet firm

The glowing reports of the potential tonnage for marine applications, because of titanium's excellent corrosion resistance, don't look much better either for the immediate future when the hard facts are appraised. We have the world's most powerful Navy already built, some of it afloat. The Navy is vitally interested in the new metal but that doesn't mean that Navy is ready today or even next year to pull apart seagoing vessels or those in moth balls and rebuild both fleets. Merchant marine craft are in a similar category. It would appear that titanium will find its logical place in new naval craft as these vessels are built and the material tested and evaluated, but the applications will not be in big tonnage for some time to come.

The chemical, food processing and petroleum industries present a somewhat brighter prospect. The titanium producers are looking at these fields with much more hope as the corrosion, contamination and working temperature problems imposed on metals by many processes in these fields can be greatly alleviated by using titanium. Many of these applications can be justified economically even at today's prices, and a slight drop in metal price would bring in many more possibilities.

Ordnance Corps, under the guidance of Col. Mesick, Commanding Officer, Watertown Arsenal, has about 100 research projects under way. On Sept. 1 their first firm application for 81 mm mortar base plates was announced. As yet their tonnage requirements are light, however the whole mortar base replacement program will take many tons of unalloyed heavy gage sheet. The base plate shown in Fig. 3 is a welded job and includes 3 forgings. A host of other applications, from wheels to guns, are under consideration. Typical are the parts in Fig. 4. Airborne ve-

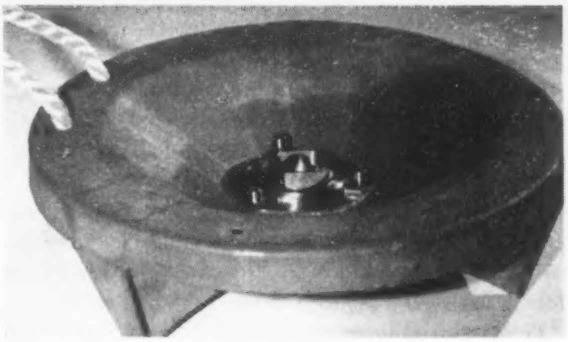


FIG. 3—This titanium, 81 mm mortar base plate has been adopted by Ordnance Corps as a standard item. An all welded assembly, the base plate contains 3 forgings, 2 of which are fully machined. The plate in titanium weighs 22½ lb and replaces a steel plate weighing 48 lb. RC-70 0.100 in. thick is cold flanged and hot dished at 1100°F. to form the top section. The three locking bolts are also of titanium.

hicles, and the trend to make each soldier a walking arsenal, point to the fact that eventually Ordnance will be the real tonnage user, but not until prices come down. Here, as in military aircraft, the actual demand will be governed by conditions which cannot be predicted with accuracy.

Two Ordnance specifications issued on July 15, 1952, outline generally their metal and sponge requirements. The mechanical property levels of the six classes of material are cited in Table X. These properties require, in some cases, high purity sponge of 140 max. Bhn, which as yet can only be secured from U. S. Bureau of Mines.

Basically, missiles, rockets and high temperature skin applications fit into a special category in which some clarification in thinking is necessary. None of the titanium produced to date can be considered a high temperature material. Melting temperature of titanium, see Fig. 5, and strength at temperature, are not even remotely connected. Designers can only use titanium for structural applications up to about 800°F max. In this sense the metal can replace aluminum and magnesium but at higher temperatures the steels are still the only usable materials.

Another more important factor that needs clarification is that a metal for missile use need not be a high strength, high temperature metal. The temperature at which a missile operates depends on the type of missile and many may operate at speeds and under conditions that magnesium or plastics can fulfill. Here again, it would appear that to date titanium has been somewhat overstressed and misunderstood as an engineering material.

TABLE IX

COMPARABLE AIRCRAFT SHEET COST (mill quantities)

(average for 48" x 144" size, same gage)

Aluminum	60 to 70¢ per lb
18-8 stainless	90 to 1.10 per lb
Unalloyed Ti	$17 to $25 per lb
Alloyed Ti	$25 to $30 per lb

TABLE X

ORDNANCE YIELD STRENGTH AND BEND REQUIREMENTS*

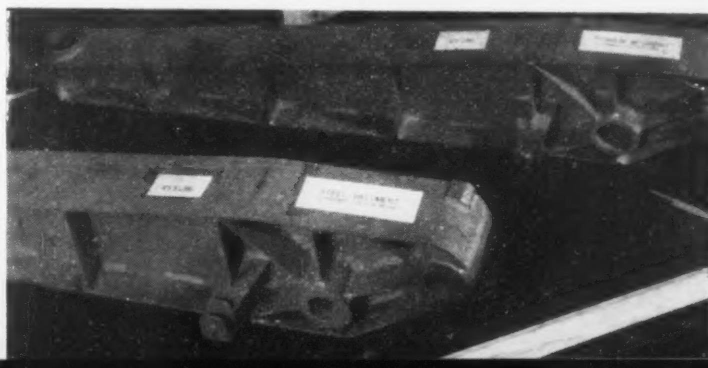
Class	Yield Strength Psi	Bend Radius[1]
40	40,000 55,000	1T
50	50,000 80,000	2T
75	70,000 100,000	3T
100	100,000 130,000	3T
120	120,000 150,000	5T
150	150,000 minimum	7T

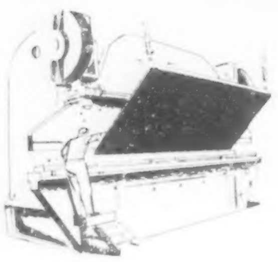
[1] T—Thickness of the Material.
* Specification MIL-T-12117.

A case in point, relative to the whole realm of supersonic equipment and flight conditions, was a plane recently tested: Everyone was worried about how to keep the temperatures down, particularly that of the pilot. As it turned out, the problem was in reverse; allegedly, he almost froze to death.

Some fields not yet investigated may show promise of rather high titanium consumption. One in particular is that of diesel truck engines. In many cases the weight limitations are serious not only to pay load and engine size but to the many other restrictions placed on large highway vehicles. Conceivably, the metal could be used to advantage either as structural or reciprocating parts. Both the other light materials, magnesium and aluminum, have been fully investigated and in most cases have not worked too well in such applications. Stainless steel trailers are now standard equipment and here again titanium might find good use. In the motor carrier field, the tonnage potential is much greater than that of commercial aircraft, but here again, high metal costs is the big hurdle which will have to be overcome.

FIG. 4—The all welded outrigger made of unalloyed titanium top, weighs 25 lb. The same part in steel, bottom, weighs 43½ lb. Ordnance Corp. expects that applications of this type will soon be commercially feasible. No production difficulties were encountered in making the titanium prototype.





Fabricating Titanium

Fabrication of sheet forms of unalloyed and alloyed titanium have presented some unusual problems. A summary of all experience to date indicates that in bending, stretching, rubber pad forming, dimpling, etc., that titanium behaves more like magnesium than aluminum. One of the earliest disappointments in working the metal was the 20 pct average elongation values obtained by tensile testing standard sheet specimens proved misleading. It was found the metal did not work harden in the plastic range which resulted in premature necking and fracture. The high yield to ultimate strength ratio as well as its hexagonal lattice are basically the cause of the forming difficulties with titanium.

Successful hydraulic and punch press forming of both alloy and unalloyed titanium between 800° and 1000°F have been previously reported on these pages[1]. The fundamental mechanical and physical properties of unalloyed and alloy titanium have been well publicized. These data are available in hand book form from all the producers and were recently republished[2].

Power brake forming of the metal can be done reasonably well by maintaining punch and dies at 500°F with the metal heated to 850° to 875°F. Because light gage sheets tend to leave the punch and seek its own radius, forming into a rubber pad is often necessary. Kirksite dies obviously cannot be used because of lead pick-up and forming temperatures. The regular Kirksite dies used for ¼ hard stainless forming might be used if they were plated to prevent lead pick up. For production runs, however, cast iron or steel dies will have to be used. Generally, a bend radii of 3½ T can be made on annealed sheet by hot forming practice.

Hydraulic press forming is done with steel dies and form blocks are usually heated to about 200°F. The part is heated to 800°F to 1000°F and asbestos sheet is used to protect the rubber pad from burning. Fig. 6 shows two aircraft parts which were started on a hydraulic press and finish formed on a drop hammer. When hot forming the usual form blocks used for ¼ hard stainless are satisfactory. The biggest trouble with rubber pad formed titanium parts is encountered on the shrink flange. The metal will not shrink because of its low compressive yield strength limitations and when formed cold the parts either break or require excessive hand forming along the shrink flange. Some companies have licked this problem by cutting V-shaped notches along the shrink flange radius of the blank prior to forming.

Experience in stretching of titanium into shapes has indicated that a number of precautions are necessary. The critical necking strain of titanium compared to aluminum or 18-8 as measured by O. A. Wheelon[3] are 4 to 10 pct for Ti, 12 to 15 pct for 24S-T and 35 to 45 pct for 18-8. The low limit of uniform elongation of titanium partially explains the difficulties experi-

Titanium 30 min | 302 stainless 30 min | 24St Aluminum 30 sec

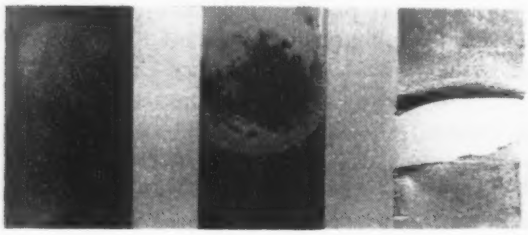


FIG. 5—Evidence of titanium's resistance to heat is the above test results. All samples were exposed to 2000°F flames for times shown.

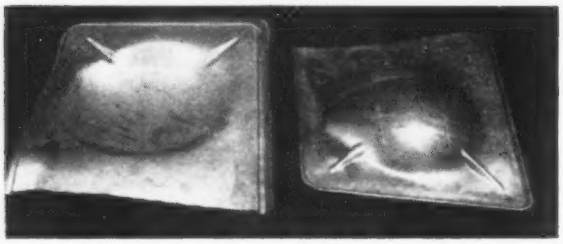


FIG. 6—These parts, made by North American Aviation, Inc., were started on a hydraulic press using the lower half of drop hammer die and rubber pressure pad. Parts were heated to 1000°F and hit several times.

FIG. 7—Unalloyed sheet 0.025 in. thick being contoured on a Hufford Stretch Press at North American plant.

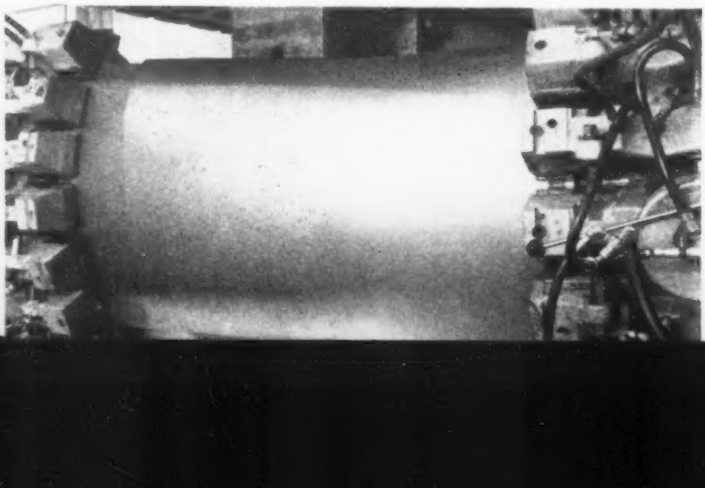


TABLE XI

RECOMMENDATIONS FOR STRETCHED SHAPES

1. Accurate sections prior to stretching should be employed. These could be fabricated by rolling, or power brake and draw bench sizing.
2. Sections should be used with a return flange on the tension side to prevent flange height loss and inhibit any necking tendency.
3. Parts should be split so that regions of high strain with straight or gradual intermediate contour are avoided.
4. The use of high webs should be avoided on severe contours. A maximum of 10 pct stretch should be used, assuming neutral axis is at inner flange.
5. Stretch blocks should be made of steel to permit the use of heat in handwork.

enced in stretch forming. In Table XI are the recommendations made by Douglas Aircraft.

Ryan Aeronautical Co. also ran quite extensive tests on stretch forming. Using very slow ram movements they found that the annealed Ti 75A, 0.071 in. gage sheets usually broke when stretched to about 1/3 the amount necessary to make the part. These breaks were explosive in nature and occurred at a maximum elongation of around 16 pct.

Combinations of a number of partial stretch-forming operations interposed with anneals at 1350°F for 10 min. produced total elongations up to 20 pct without breakage. However, cleaning of the scaled part is sometimes necessary to prevent press jaw slippage and usually the surface shows a definite orange peel pattern. Hot stretching at low temperatures around 400 to 500°F usually requires 1 or 2 anneals if the total elongation in the metal must be over 20 pct to make that particular part. Higher temperatures around 1000°F preclude the intermediate anneal and make forming easier but are somewhat harder to control and handle. Moderately difficult stretch forming, however, is being done today at around 465°F and it has been found that the same high temperature lubricant used in hot forming magnesium works equally well with titanium.

Stretch forming of skins is not as difficult as shapes but so far tooling costs have been high in regard to the number of parts required. Best contours are obtained by holding the stressed sheet at maximum load. In stretch forming as typified in Fig. 7 more scrap is generated because excess material is needed for gripping. Until sheet prices decrease and a ready market for the excess scrap generated is found it is believed that titanium parts by stretch forming will be high priced in relation to other fabricating methods.

Use rubber pads on drop hammer

Drop hammer stampings common to many aircraft fabricating methods have been used on titanium. The sheet metal duct parts shown in Fig. 8 are common to aircraft manufacture. At times rubber pads are used under the part on the hammer. Some parts are started with rubber pads and then bottomed in the die after the rubber pad is removed. North American Aviation drop hammer forms their parts at 1000°F.

Ryan Aeronautical Co. sums up their drop hammer experience as follows: "As a result of the successful drop hammer forming of the shroud assembly we have concluded that the temperature at the instant of impact should be at least 800°F and preferably near 1000°F to achieve the optimum in formability." Although lead punches and Kirksite dies could be used for a limited number of parts, it was found that the high temperature of the blanks tended to pick up lead from the punch which would shorten its life considerably. Heating of the material for forming is complicated in the case of large, unwieldy parts. For smaller parts, torch heating, or heating in a standby furnace, have been acceptable methods. In some cases these techniques are employed in the fabrication of stainless steel drop hammer stampings.

FIG. 8—Titanium ducting parts formed on a drop hammer at 1000°F. Rubber pad was used underneath left hand part to hold shrinkage. Other two parts were drop hammer formed without pads.

There are also advantages in keeping the dies at a moderate temperature to prevent the rapid cooling which is encountered with cold dies. Parts with complex curves will probably require a certain amount of hand work between each draw of the drop hammer. This is essential if there is any tendency for the part to wrinkle.

W. G. Hubbell, Chief Metallurgist of Ryan, recently developed a rather simple test to obtain ductility characteristics of titanium under impact loading at various temperatures such as found in drop hammer stamping work. A spherical cavity 3/4 in. in diam and 7/32 in. deep is machined into a steel plate. By measuring the total deformation possible after forcing the sample into the cavity it was possible to obtain a quantitative evaluation coordinated with various heat treatments. A measured impact load is applied in this case to a steel ball which forces the test material into the hole machined in the plate. Typical deformation characteristics developed by using this test on Ti 75-A sheets are shown in Table XII. These sheets as delivered possessed

TABLE XII

DEFORMATION TEST FOR TITANIUM

Deforming Temperature	Treatment	Deforming Characteristics
Room	None	Cracked when deformation was about 50 pct complete.
Room	Deformed 50 pct of possible, annealed 1 hr at 1170 °F. Deformation then completed.	No cracking.
Room	Deformed 50 pct of possible, annealed 40 min. at 1170 °F.	No cracking.
Room	Deformed 50 pct of possible, annealed 20 min at 1170 °F. Deformation then completed.	Cracking appeared imminent.
450 °F	Previously heated to 1300 °F.	Cracked when deformation was nearly complete.
750 °F	None	Cracked when deformation was about 75 pct complete.
1000 °F	None	No cracking.
1300 °F	None	No cracking.

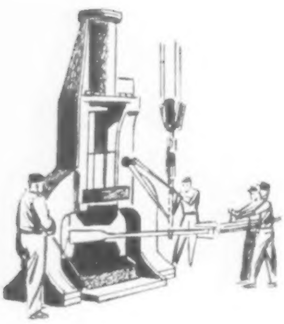
the following properties: 87:700 psi U. S., 65,000 psi Y. S. and 22 pct elong. in 2 in.

Not enough good data has been developed yet on deep drawing of titanium. Until very recently sheet quality has not been good enough to attempt a general testing program. A few such projects are just getting under way and results will be available in a few months.

Spinning of unalloyed titanium sheets has worked fairly well. One company, Southern California Metal Spinning Co., employs half hard naval bronze tools with excellent results. This company employs two cold preforms each followed by an 1150°F anneal. Final spinning is done hot between 475 to 500°F. Butane burners heat the metal and the chuck is preheated.

Sheets 0.062 in. thick are spun with tolerances on the I.D. running 0.010 in. Regular spinning soap is used on the cold preforms but no lubricant is used on the hot finishing spin.

Punch press is not generally recommended for titanium parts. Forming temperatures of at least 800°F are necessary which means that the dies must be redesigned to counter the expansion of these dies at working temperatures. Hydraulic press forming is generally cheaper and easier.



Titanium Forging Practice on Typical Experimental Parts

Most published literature concerning forged titanium have overlooked metal cost and costs of operations subsequent to receiving a finished forging which are necessary in order to use the forging in any given application. Titanium can be forged and in general ranks with aluminum and some stainless grades in this regard. Many parts have been forged, most of them from the titanium grades shown in Table XIII. Forging temperatures, annealing temperatures, etc., have been well publicized but costs of forgings have not received too much attention.

In the case of one aircraft maker a detailed study of costs produced the comparison shown in Table XIV. At these figures the use of the metal is prohibitive in most airframe construction. This part was approximately 20 in. long, 4 in. wide and ranged from ½ to 3 in. thick. As machining methods improve the cost of finish forged parts will decrease and will permit wider consideration of titanium in such places. Titanium producers usually cite a machining cost of 3 to 3½ times that of steel parts. Experimental machining tests by consumers have run as high as 10 times, to 20 times that of alloy steels. One of the few published reports which dealt with costs of forging[4] cited a cost increase of 50 pct

TABLE XIV

FORGING COST ANALYSIS—TANK SUPPORT FITTING

Description	8630 Steel	Titanium Alloy RC 130B	
Lot size	800	500	500[1]
Cost of forging stock	$0.10/lb	$10.00-13.00/lb	$10.00-13.00/lb
Wt. of forging billet	.....	19.5 lb	19.5 lb
Wt. of rough forging	23.5 lb	13.8 lb	13.8 lb
Material cost forging	$6.00	$248.82	$248.82
Forging cost part	$1.90	$76.18	$76.18
Total cost of forging	$7.90	$325.00	$325.00
Machining cost part	$58.00	$1000.00	$174.00[1]
Total cost finished machined part	$65.90	$1325.00	$499.00
Wt. saved/part	......	5.9 lb	5.9 lb
Cost per lb. of wt. saved	......	$225.00	$83.00

[1] Analysis based on machining time and costs of 2½ to 3 times cost of alloy steel parts; the machining cost factor usually quoted by the primary titanium producers.

TABLE XIII

NOMINAL COMPOSITION AND PROPERTIES OF SOME TITANIUM FORGING ALLOYS

		Nominal Composition Pct					Nominal Annealed Mechanical Properties			
Designation	Producer	CaCb.	Al	Cr	Fe	Mn	Yield Str. 0.2 pct offset psi	Tensile Strength psi	Elong. pct 2 in.	Red. of Area pct
RC 70	Rem Cru	0.2 max	......	......		......	80,000	90,000	20	50
RC 130B	Rem Cru	0.2	4	......	......	4	140,000	150,000	20	40
MST 3Al-5Cr	Mallory-Sharon	0.5	3	5	......	...	153,000[1]	165,000[1]	8[1]	25[1]
Ti 150A	Titanium Metals	0.02	......	2.7	1.3	..	120,000 min.	150,000	15 min.	....

[1] Hot forged 80 pct reduction.

for material and 100 pct for machining over alloy steels. The use of CO_2 offers promise in reducing costs, but to date more experience is needed before actual machining costs for large part production can be intelligently assessed.

The criticisms leveled at some forgers for what is called excessively high prices of forgings is not exactly fair. In the first place, it must be remembered that the man on the hammer has in the tongs a piece of metal which costs many times as much as ordinary metal forging stock. In the case of one part made of 4340 the forging was worth 45¢, the same part in titanium cost about $60 to $70. A forger can absorb reasonable scrap in the first case but what can be considered reasonable scrap losses in the second case? In addition the forgers have a ready market for practically all steel and aluminum scrap but he has no market at all for titanium scrap so that a rejected titanium forging is 100 pct loss.

Hammer time for titanium forgings is not much more than on stainless alloys although 2 or 3 heats are common in forging one titanium part. In forging of jet blades as many as 10 reheats are not uncommon. However, these costs are negligable to material costs. Some alloys can be reheated repeatedly without impairing the properties of the forgings. Other alloys are sensitive to reheating as well as to soaking at temperatures much over 1650°F.

The maximum weight savings of 40 pct in using titanium alloy forgings should come from substituting titanium alloys of equal strength to the steel alloys now employed. In airframes this strength range will generally vary from 120,000 to 150,000 psi U. S. If the part can be designed to take advantage of higher tensile strength, alloys up to about 175,000 psi U. S. can be used to better advantage but so far very few such high strength titanium forgings have been made. Fig. 9 shows a group of small drop forgings typical of parts forged by one company which are now being considered for regular production.

Landing gear application questionable

The application of titanium to landing gear forgings is being tested but two major drawbacks are involved in addition to high metal and machining costs. Such forgings must be fairly weldable and possess very high strength. One company regularly employs Crucible Hy-Tuff for large landing gear and this material is heat treated to tensile strength of 220,000 to 230,000 psi with 15 pct elongation in 2 in. AMS 4340 steel also used for landing gear has equally high strength and can be welded. Both metals are cheaper, stronger, more readily fabricated than any titanium alloy yet developed so that titanium in these applications has to compete with materials of higher strength, weight, ratios.

Present impact requirements on heat treated steel landing gear vary considerably. One company makes large gear of alloy steels which are welded and heat treated. The impact properties are quite low but this drawback is alleviated by proper design. It would appear that titanium might make the grade for landing gear forgings if the designers can conjure up an assembly wherein the brittle titanium alloy welds will not impair the safety of the gear.

One company, Steel Improvement & Forge, has forged numerous titanium parts weighing from 0.19 to 594 lbs. The three major factors concerning forgings in their experience are part design, die sinking and raw material. The bulk of their production has been in the rotor disk forgings of the alloys Ti-150A, Ti-175A, MST 3A1-5Cr and unalloyed RC-70 and Ti-75A.

In forging close attention must be given to the flow characteristics of the material. The metal, while sluggish, usually exhibits normal flow characteristics, although there is a distinct tendency to extrude through thin section rather than follow the die contour, making it difficult to fill rim sections or bosses, when using conventional design. For this reason it often requires additional dies of more extended design, or possibly intermediate dies, for a forging previously made in steel, to be converted to titanium.

Also attention must be given to the selection of a proper die block size and hardness range. Generally speaking, titanium requires approximately 30 pct greater delivered impact to effect the same flow pattern as compared to steel. This factor greatly influences die life characteristics, accelerating "washout" conditions.

Dies for the forging of titanium and its alloys, require the same general precautions as that

FIG. 9—Typical drop forgings made by Consolidated Industries, Inc. The two small parts and the ring at lower left are outer inlet vane trunnions and a bearing housing respectively. These are jet engine parts forged from RC-70. The top center arm is for a main landing gear actuator forged from RC 130A. The lower right hard part is a lifting lug forged from RC 70. Largest part, the arm, measures 7 in. across.

Titanium forgings tried in jets—

used in sinking dies for forging aluminum. It is highly essential that the final benching be finished by a buffing operation which removes all marks resulting from previous machine work, such as milling, planing, boring, etc. This is important because the presence of any tool marks will carry through in the finished forging, since these materials do not scale as with steel. Subsequent cleaning operations will not eradicate these indications as they do in the case of steel forgings.

Titanium shrinks less

Another factor in the sinking of dies for titanium and its alloys, is that of shrinkage. Generally, it is the practice to sink steel dies allowing for a shrinkage of 0.187 in. per ft, whereas for titanium the shrinkage amounts to only 0.100 in. per ft. This factor, too, must be considered in the case of designing dies for large sections, since existing dies used for forging steel cannot be used unless dimensional discrepancies resulting from shrinkage differentials are within design limits for the specific applications.

High quality surface on titanium bar stock is a must. In upset operations, for example, the presence of longitudinal defects such as seams, or heavy guide scratches, will act as stress risers, even at forging temperatures, and will result as initiating points for open ruptures. Seam depths of as slight as 0.0015 in depth have resulted in scrapped forgings with an upset ratio of less than 2 to 1 based on cross-section.

Five step cleaning method

The method which Steel Improvement has established for controlling this condition is: hot acid pickle cut multiples prior to any forging run. They are currently using an acid solution consisting of 40 pct hydrochloric, 10 pct nitric with the balance water. While this mixture is far from adequate for stock exposed to temperature, it does bring out any surface imperfections on the rough turned and centerless ground material.

The usual procedure for successfully removing the oxide from the surface of forgings is: (1) shot blast, (2) immerse in 60 pct caustic for 10 min, (3) rinse, (4) immerse in 8 pct nitric-2 pct hydrofluoric solution for 15 min, (5) rinse and scrub. These conditions of time can vary with the nature and severity of the oxide layer.

The heating of titanium for forging poses no special difficulty. Heating can be done successfully in an open gas fired furnace of conventional design, or in an electric furnace with a gas curtain. In cases a slightly oxidizing atmosphere gave the best results. The temperatures generally employed range from 1650° to 1800°F, although some forgers limit their working range from 1650° to 1750°F, depending on the severity of the forging operation. Others hot work over the whole wide working range, 1800° to 1400°F, although prolonged heating above 1700°F limits the amount of effective flow below 1500°F.

In special cases using light blows forging is continued down to as low as 800°F to straighten, obtain closer tolerances or to impart higher mechanical properties to the forging. Generally below 1300°F the metal resists impact of the hammer due to higher compressive strength with lower temperatures. Hot hardness of titanium

TABLE XV

HOT HARDNESS OF TITANIUM

Temperature °F	Hardness, Rockwell "A"			
	RC 55	RC 70	RC 130A	RC 130B
80	60	61	69	68
300	52.5	56.5	66.5	66.5
400	47	51	62.5	63
500	41	47	59.5	61
600	35.5	42	57.5	59
700	32.5	36	55.5	56.5
800	30.5	32.5	52	52.5
900	26.5	30.5	50	49
1000	21	26.5	44.5	40
1100	8.5	17.5	34.5	27
1200	Off Scale	Off Scale	20.5	8
1300	....	....	Off Scale	Off Scale
80*	60	61	69	68

* Note—All grades returned to original hardness.

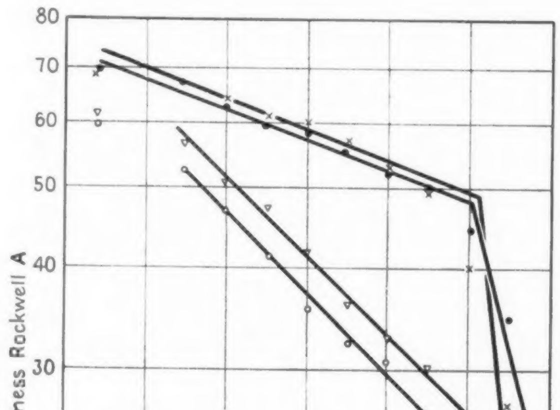


Fig. 10—Semi-log plot of hot hardness of 4 types of titanium. Research was done by P. R. Mallory Co. on an Ordnance Corps. research project.

and hot compressive or tensile strength have not yet been correlated. Fig. 10 is the result of a hot hardness survey on 4 types of titanium run at P. R. Mallory & Co. for Ordnance Corps. These data summarized in Table XV show that the metal must be under 1300°F to even register on the Rockwell A scale.

A Rockwell hardness tester was modified to permit elevated hardness measurements under argon atmosphere. Each hardness valve represents the average of two tests run on separate samples from the same bar. Research on all other alloys is continuing under sponsorship of Ordnance Corps.

The heat treatment given the forgings prior to shipment in most cases is generally specified by the customer and normally consists of either (1) a stress-relief anneal treatment-heating for ½ hr at 1300°F and air cooling or (2) heating to 1650°F for 1 hr followed by an air cool. Normally alloys of the high carbon type are furnace cooled from the annealing temperature.

Special annealing treatment used

At times some difficulty in meeting hardness requirements of certain forgings, in spite of various types of heat treatment. In one run of forgings a study was made by Steel Improvement & Forge Co. of incoming bar stock which was furnished annealed. These studies revealed that the hardness of the incoming material and that of the annealed forging were identical, both of which were considerably over specification. Experimentation was conducted on the basis of data obtained from certain West Coast fabricators which resulted in a material reduction in hardness. This treatment involved prolonged soaking at 850°F followed by a water quench and then reheating to 1180°F for 2 hr and air cooling. Ordinarily annealing alloy titanium forgings only softens the parts by about 7 points Rc.

Another problem which confronts the commercial forger in the fabrication of these forgings such as compressor blades is that of a straightening; particularly where small quantity lots are involved. Shock straightening, such as hand straightening, or press straightening, frequently results in breakage. To overcome this, if a job is such that trim pads cannot be used, heating in the range of 400° to 600°F greatly facilitates the straightening operation and eliminates breakage, when done hot. This same practice is followed if excessive conditioning is necessary between operations. In most cases, however, grinding can be done at room temperature, providing that the forgings are given an immediate stress-relief anneal at 1300°F.

Most of the titanium forgings produced to date have been for jet engine application. The early sad experiences, see Westinghouse Engineer, July 1952, p. 120, are not indicative of present conditions but the hard fact remains that no jet engine parts of titanium are actually flying or are in daily use. Engines containing titanium parts are still on the test cells on the ground.

TABLE XVI

JET ENGINE PARTS FOR J-73 ENGINE*

Part	Alloy	Top Operating Temp.	Prime Metallurgical Requirement
Forged wheels....	RC 130B Ti 150A	600°F	Low creep rate
Forged casings last 4 or 5 stages only	RC 130B	500°F	High yield strength
Forged bearing housings	RC 70 or equivalent	700°F	No special requirement
Forged blades, stator, rotor	RC 70 or Ti 100A Ti 150A or RC 130B	700°F	15 pct min. elongation in 2 in. High fatigue properties
Spacer rings flash welded	Ti 150A	700°F	120,000 psi min yield 7 pct min elong. in 2 in. across weld

* Total of 350 to 400 lbs of titanium per engine.

General Electric Co. was one of the early companies which investigated and tested jet engine parts. This company's major titanium requirements for their J73 engine is shown in Table XVI, listed in order of weight saving importance.

Using the strength levels of commercial alloys such as Ti-150A and RC-130B GE has designed wheels capable of saving many pounds per engine. Ductility is a highly important requirement for rotating parts. Bursting tests run by GE on dimensionally identical disks have shown a broad range of speeds for bursting. This has been accounted for largely by differences in ductility. Unless a highly stressed part can locally readjust itself by plastic deformation, stresses rise locally to the fracture level at bearing points and section changes.

Alloy segregation cuts ductility

The ductility found in a wheel forging is a result of both composition and history of the metal. Composition affects ductility more through variations within an alloy than through contrast between alloys. The heating and working schedules during forging also affect ductility. For instance, the Cr-Fe-Ti alloys exhibit a grain boundary brittleness after heating above 1650°F. The large grains resulting from high heating appear to be ductile, but the fractures are nearly 100 pct intergranular. A constituent is evidently ejected by the beta grains to the boundary region where it causes brittleness. Brittleness from heating to the all beta region is the usual case. Minor variations, probably in composition, have occasionally permitted heating to the all beta range without embrittlement. If a large forging reduction is made while the alloy is cooling down to the alpha-beta range, the beta boundaries are broken up

Ductile forgings important—

and ductility is restored to the finished forging even if heated above 1900°F.

Aircraft quality in titanium products is essential to successful applications. In the case of disk forgings the billets must be clean inside and outside. Discontinuities such as tungsten or graphite inclusions or segregations from incomplete fusion of alloy additions can dangerously lower ductility in local regions.

A disk forging which has been produced with a good surface, well filled contours, and adequate properties is still no good if there are internal discontinuities. Aircraft quality by magnaflux testing methods cannot be used on titanium. Surface inspections by Zyglo and similar methods can be employed. Sonic testing and x-ray can be used to check internal soundness but as yet no industry standard quality tests have been written for aircraft parts.

Practical fabrication of wheels from forgings will depend on machining techniques. Rough machining would be greatly aided by a method of removing the forging surface before actual machining was started. The case hardened layer below the forging scale probably causes more grief to machinists than any other single factor. General Electric has found that in turning, machining costs of titanium are only 1½ times more than that of regular alloy steels.

Welded casings not yet approved

Another interesting application of titanium forgings in jet engines is their possible use in compressor castings. Toward the hotter end of the compressor aluminum cast alloys creep rather badly under operating stresses. Rather than using steel for such a large heavy part GE is making an effort to use titanium. Several designs calling for forming and welding have been suggested. They believe that welded designs will have to stay on the shelf until weldable alloys appear. Meanwhile, they are making casings by contour forging plates of titanium alloy and machining the desired contours. Other parts not for jet engines are in the same experimental status by other companies, see Fig. 11.

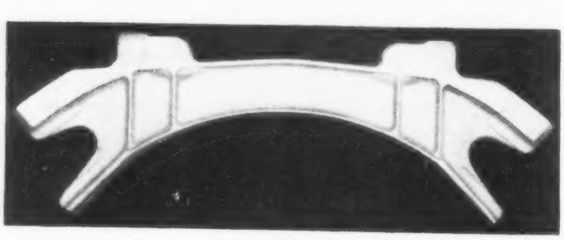


FIG. 11—An experimental forging for Lockheed made by Transue and Williams. This part is 32 in. long x 8 in. wide forged from MST 3 Al, 5 Cr, titanium alloy.

Ductility is important in casing parts as there are many stress raisers in the vicinity of the joining flanges. Surface quality is important since the outer surface is stretched during forming and the inner surface must clean up without too much waste of material to accurate dimensions. The machining of the casing is a terrific job. Contour forging of the outside of the casing will make the fabrication more practical. The cost of using casing of titanium at present is much too high.

Jet engines require blade forgings to be at least somewhat ductile in all directions. Because of changes in directionality within the material during forgings, ductile titanium alloy bars can make very brittle blades. The blades in most cases are of cantilever design. Consequently, vibration and shock loading are of primary concern. General Electric tests every blade they make for ductility and are constantly trying to arrive at bar acceptance tests which can be met by the suppliers and which will assure us of ductile blades. So far they have never made a brittle blade from bar which was below Rc-36. But hardness is not well correlated with ductility as at Rc-39 some blades are very brittle while others have more than adequate ductility.

Blade finish highly important

Other requirements of forged titanium blades are needed to assure their successful application. The blades must be near perfect in dimensions and finish. No folds or other surface imperfections are allowed. Finishing marks are removed to eliminate sources for fatigue failures.

Titanium compressor blades appear desirable largely from weight-saving standpoint. While each blade weighs only a few ounces, there are nearly 2,000 blades per engine. It appears that there is sufficient difference in stress levels for stator blades as compared to rotor blades that the two may be made from different titanium alloys. The stator blades have air loading and vibrational stresses but no centrifugal loading; consequently, it may be quite feasible to use a lower alloy such as Rc-70 or Ti-100A. The lower alloy is apparently more ductile and should eliminate the chance of producing brittle blades.

The cost of titanium blades is not so far out of line as the larger forgings for wheels and casings. Forging operations on the blades are so many that material becomes a smaller fraction of the total cost.

At General Electric every steel part is under consideration for titanium substitution where temperature permits. Already being developed are shaft couplings, accessory drive gears and bearing housings. Each can be machined from titanium of sufficient size, but each can probably benefit from forging. More efficient utilization of material can be realized as well as mechanical property benefits from proper grain flow.

Welding Titanium

Weldability of titanium, just as in other metals, is a relative term. Generally unalloyed titanium is entirely weldable with resulting good ductility and strength. The alloys weld equally well but are brittle. As yet no heat treatment, prior or post heating methods have been developed to remedy this embrittlement. Most metallurgists and welding engineers don't believe that the present alph-beta alloy will ever produce ductile welds and new alloys hold the only hope of overcoming this problem. Some operating and fabricating experts don't agree.

There are those in the aircraft companies who believe that weldability has been overstressed. They point out the 75-St aluminum is not exactly a readily weldable material but is used in tonnage both in the welded and in otherwise fastened type of assemblies. They imply that if the purists can be sidetracked long enough for the fabricators to work out their techniques that the present poor reputation of welded titanium might be salvaged.

Hold O_2, N_2 and H_2 to 0.20 max. total

The three impurities in titanium responsible for embrittlement can usually be tolerated in welding if the sum of the oxygen, carbon and nitrogen do not exceed 0.20 pct. For good ductility the maximum of each single element is 0.15 pct O_2, 0.05 pct N_2 and 0.15 pct C. Usually any unalloyed titanium meeting these conditions of purity can be satisfactorily welded as long as the welding operation doesn't increase the contamination. Although the same contamination requirements hold for the alloys they are of lesser importance. The only reason they are of lesser importance is that no matter how high the purity, brittle welds still occur in alloys and are due to the decomposition of the unstable beta phase.

In fusion welding great care must be taken to protect the weld from contamination by air. In these cases most of the troube encountered in welding, i.e., contaminated and therefore brittle welds in unalloyed titanium, are due to mechanical maladjustments rather than problems any more difficult than encountered with good welding techniques for aluminum or stainless. In the case of spot or flash welding no problem of protection of the weld area exists.

Rohr Aircraft Corp. has done considerable work on welding and their preliminary conclusions on fusion welding are: "The problems encountered in fusion welding of unalloyed titanium are very similar to those of stainless steel." The major difference is tighter controls on all variables when welding titanium. The proper mating of the butted edges and the surface preparation are more critical. The maximum gap between the two sheets when butted together should not exceed 8 pct of the material thickness. The inert atmosphere must give more protection of the fused zone for a longer period of time than when welding stainless.

A typical example of the test settings used by Rohr on DC 300 amp welders for titanium 75A, .025 in. thick was: a mixture of 7 liters of helium, 14 liters of argon—7 liters pressure on the top and 15 from the back. This material was welded at 23 ipm and 20 amps of current. The back-up bar has a "V" shaped slot approximately ½ in. wide at the top. The gas enters through holes, at the vortex of the slot, which are 1/16 in. apart. This back-up bar is the only component of the machine that had to be changed for the purpose of welding titanium. The original bar did not have as deep or as wide a slot and shielded the weld in spots only. Past practice on machine welding has been to control the penetration by the speed of travel and it was found necessary to weld about ½ as fast when welding titanium as when welding stainless. From the first this company has been successful in obtaining a weld bead having excellent appearance. However, they feel that Ti-75 and Rc-70 can be welded with improved ductility of the weld and weld area as tensile tests on the weld metal show elongation of only 12 to 16 pct. Bend tests showed a bend of 180° with a 2T radii on .025 in. samples.

Fig. 12 shows the bottom of the all welded 81 mm mortar base plate. All welds are fusion

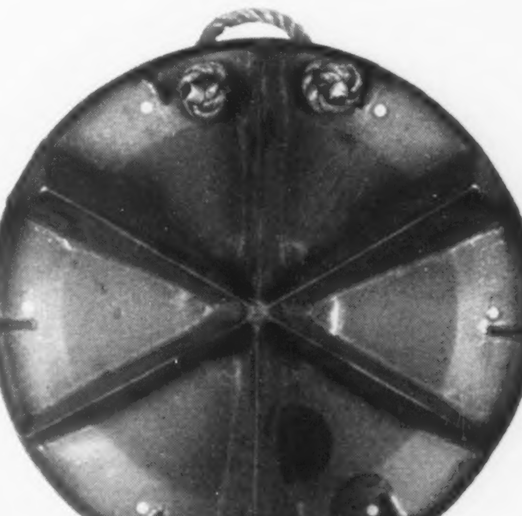


FIG 12—Bottom of the all welded 81 mm mortar base plate. All welding was done with regular argon shielded, tungston electrode gun. Filler rod was made from RC 70 sheet sheared into strips. Sound ductile welds were obtained with no special precautions.

Pure titanium welds well—

welds done with a regular Heliarc tungsten electrode welding gun using argon to shield the arc zone. The base plate is made of RC-70 0.100 in. thick and the filler rod material is made by shearing into the strips some of the same stock used to make the plate. The welders at the Arsenal report no difficulties of any type in welding and tests show all welds of high quality and good ductility.

No ductile alloy welds produced

Fusion welding of the titanium alloys have not produced ductile welds to date by any process except flash welding. The problem here is a metallurgical one rather than mechanical. Until all alpha type of alloys are available it is not believed that the present limits of 5 pct max. elongation in the weld or heat affected zone of the alpha plus beta alloys will be improved.

Resistance spot welding of unalloyed titanium has shown good results. Basically titanium lends itself to this method because of its low thermal conductivity and low coefficient of expansion. Strength of spot welded joints are not affected greatly by the oxide coating which forms on the metal at room temperature. Hot formed scale, however, must be removed. Sodium hydride cleaning followed by water washing and then a bright dip in 10 pct HNO_3 ¼ pct HF and pickle in 10 pct HNO_3—2 pct HF is recommended by some producers on any stock which is to be welded by fusion or spot methods.

Practices for cleaning varies with each shop. Rohr Aircraft for instance, measures surface cleanliness with a micro-ohmmeter which they have used for years to measure the surface cleanliness of aluminum prior to spot welding. Others merely give the metal a good cleaning and weld it immediately without further checks. North American Aviation, one of the largest aircraft users of titanium to date, has been running welding tests under Navy contract and on their own. Fig. 13 indicates the spot welding characteristics of RC-70 annealed sheets as found by North American. Fig. 14 sums up their recommendation for AC machine settings for spot welding RC-70 sheet.

Same shear values as stainless

Although there is no good agreement in the industry on the precise value of tension or shear tests, these tests are being made on spot welded titanium samples. In cases, shear values on unalloyed titanium are about equal to those obtained on ¼ hard stainless. In other cases, the results vary widely due to conditions of test, weld penetration, diameter of button, etc.

Generally, the ratio of tensile to shear strength of titanium both that of commercially pure and alloy is lower than that of spot welded 75-ST or 18-8 stainless. Ratios of tensile to shear strength for Al and stainless range from 30 to 80 pct. In unalloyed spot welded titanium this value has ranged from 20 to 40 pct. In spot

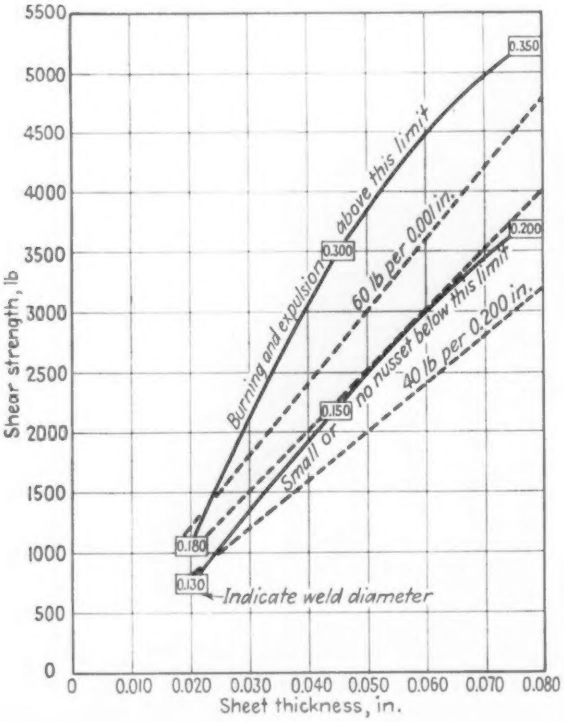


FIG. 13—Spot welding characteristics of RC 70 annealed sheets as found by North American Aviation Co. Work was done under Navy Bureau of Air contract.

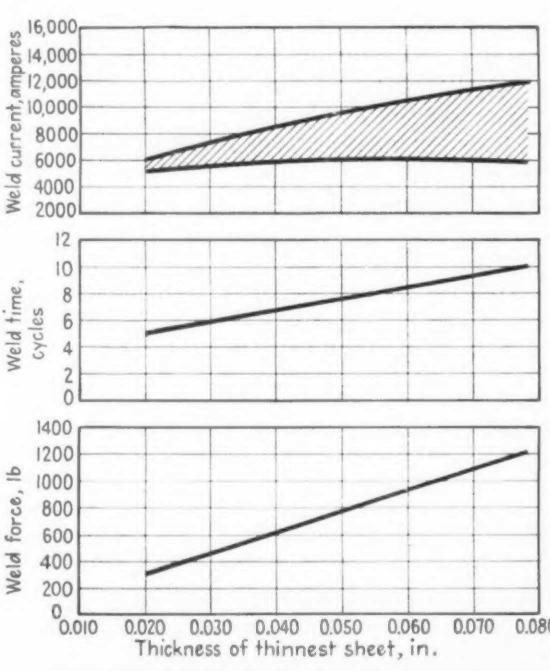


FIG. 14—Spotwelding settings for AC machines for RC 70 annealed sheet. Courtesy North American Aviation and U. S. Navy.

welded alloys the range drops to ratios of 10 to 15 pct and here again it is a case of unstable beta phase characteristics of the alloys rather than a case of welding techniques.

One of the spot welded assemblies just being put on a production basis is shown in Fig. 15. Exhaust shrouds for the helicopter engine are made from Ti-75A. Severe forming and many spot welded fittings are involved in this part which will insulate the plane from the heat of the exhaust system serving the buried engine in the Hub-1 helicopter.

Welding embrittlement in spot welded alloys occurs in two regions. One area is in the heat affected zone; the other is in the cast metal nugget itself. Ductility can sometimes be restored to the heat affected zone of alph-beta alloys by reheating to around 1100°F and slow cooling to room temperature. This treatment, however, does not restore ductility to the cast metal of the weld and freezing is too fast to slow down the decomposition of beta or stop alloy segregation during the weld operation itself.

FIG. 15—Ryan Aeronautical Co. employee adjusts a Ti 75A shroud over the exhaust system used by Piasecki Helicopter. Spot welded assembly of severely formed titanium parts operates at 500°F.

Flash welding holds ductility

Flash welding has produced the ductle welds made in alloy titanium to date. In this process the molten metal does not end up in the joint and the only area of embrittlement possible is the heat affected zone. Sound welds of good ductility have been produced by the American Welding & Mfg. Co. by flash welding in both unalloyed and titanium alloys. As in spot welding no protective atmosphere is required. Early in 1949 this company successfully flash welded ½ in. diam rods of unalloyed titanium. All welds were sound and ductile.

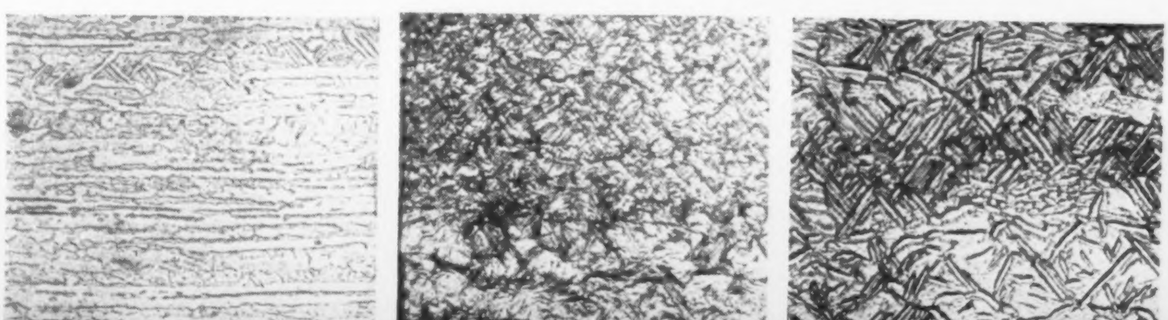
The introduction of the higher strength alloys such as RC-130B and Ti-150A presented a problem not normally encountered in flash welding other ferrous and nonferrous materials. This was the apparent sensitivity of titanium to crack in areas of surface or structural discontinuities. Bars which had surface defects removed by grinding just prior to shipment from the mill cracked when the bars were clamped in the welding machine. One lot, which had been checked for hardness at the mill, fractured through the Brinell impressions.

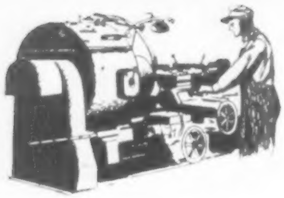
If fracture did not occur at these points immediately upon clamping the cracks appeared sometime after the weld was completed. The additional stresses set up by the thermal gradient during the welding cycle apparently are sufficient to cause failure. When bars were annealed at the mill after surface preparation, no trouble was encountered. It was found that a rough chip or grand mark resulting from burr removal of the welded bars could give rise to cracks, but cracking could be avoided by getting the welded rings into a furnace at 1300°F for 15 min immediately after welding, followed by an air cool.

A typical weld cycle for 2 x 5/16 in. bars of RC-130B flash welded into a ring consumes 8 sec with the voltage (open circut) at 6.2. Flashing travel was ¾ in., upset travel ⅜ in. and final die opening is usually 1⅛ in. That cycle produced welds of 152,000 T.S., 146,500 yield, and 15 pct elongation in 2 in. with a reduction in area of 46 pct.

With flash welding no cleaning of the ends to be joined is necessary. Rough rather than smooth ends are preferred as the arc is more easily established with rough mating surfaces. The rough current at around 10,000 amps flashes away the two mating surfaces and in effect electrically machines and cleans the edges to be joined. No trace of a molten constituent is found in the flash welded joints, see Fig. 16.

FIG. 16—Micrographs of flash butt welded Ti 150A made by American Welding and Manufacturing Co. All samples were etched with 2 pct HF50 pct HNO_3 rinse, mag is 500x. Weld zone is in center of the middle photo. Annealing temperature was 1300°F. Left to right: Parent metal, as welded, and welded and annealed.





How to machine titanium

Machining has been mentioned in former parts of this article as it is common to the manufacture of parts made by all processes. Many difficulties have been experienced in machining titanium for the reason that the metal is unique in physical characteristics and the industry had no previous experience. Many of the initial problems have been solved but titanium is still a special animal that requires different machining techniques.

The major causes of titanium's poor machinability are (1) smearing and galling which causes metal buildup on the tools (2) work hardening which can dull the tools and (3) abrasive action of hard titanium carbide on the cutting edge of the tool. All these factors are related so that the only good approach is to tool up to prevent any of the above troubles. Fig. 17 illustrates the effect of carbon on tool life of a K-8 tipped tool.

Titanium in which the carbon content is below 0.20 pct will not generally contain enough hard carbides to dull the tools if super hard alloy or carbide tools are used. Because the metal has low thermal conductivity more than ordinary cooling of the tool and the workpiece must be provided.

Carbon dioxide has been reported to vastly improve the machinability of both alloyed and unalloyed titanium.[5] The recommended type of tools for major machining operations as well as feeds and speeds are shown in Table XVII.

Major factors to insure optimum machinability are: (1) plan parts so that there is as little metals removal as possible, as titanium costs money and chips can't usually be sold. (2) use sharp carbide or carbide tipped tools whenever possible. (3) take as heavy cuts as machine and part will permit. (4) hold work rigidly, support firmly. (5) direct coolant at high pressure to the cutting edge of tool. (6) use adequate cutting edge to avoid side drag. (7) use chip breakers when turning and drilling.

TABLE XVIII

RECOMMENDED GRINDING ABRASIVES

Grinding Operation	Carborundum Company	Norton Company
Rough Grinding, Snagging	C3A203-N-B5	A14-Q4B7 32A46-G12VBEP
Intermediate Grinding	A303-O-B5	
Cylindrical Grinding	*A465-K6-V11 †A80-K6-V11	32A80-J8VBE
Finish Surface Grinding	DA46-K9-V20	32A46-I8VBE

* Work diameter $1\frac{1}{2}$" and larger. † Work diameter under $1\frac{1}{2}$".

Satisfactory abrasives for grinding have been developed for particular grinding operations, see Table XVIII. Generally wheel speeds of 2000 to 3000 sfpm and table speeds of 400 to 500 ipm are recommended. Feeds should be about 0.001 in. per pass and proper coolants are important. With low wheel speeds oil coolants are satisfactory as not enough sparking is involved to fire the oil. At high speed particularly on rough

TABLE XVII

RECOMMENDED MACHINING METHODS

TOOLS		FEED ipm	SPEED sfm	REMARKS
Turning				
Material	carbide, cast iron or super hard grades	0.015 to 0.018	90 to 110	$\frac{1}{8}$ to $\frac{1}{2}$-in. depth of cut, high C, Ti
Side rake	3 to 7	(roughing)	150 to 170	" " " " " " low C, Ti
Back rake	0°			
Side cutting edge angle	0°	0.0006 to 0.008	100 to 120	0.030 to 0.060-in. depth of cut
End cutting edge angle	6°	(finishing)		
Relief	6°			
Radius	0.030 in.			
Drilling				
Material	cobalt high speed steel	0.008 to 0.020	12 to 15	For drills up to $\frac{1}{4}$-in. diam.
Point angle	118°			
Clearance	12 to 15° on 28° spiral			
Reaming				
Material	carbide tips	0.005 to 0.008	100 to 200	0.012 to 0.030-in. depth of cut on
Flutes	4			the diameter
Back taper	0.0002 in. per in. flute length			
Primary clearance angle	10 to 15°	Up to 0.020		On large diameters
Chamfer angle	45°			
Tapping				
Type	Interrupted 3-flute, spiral point tap, high speed steel	....	12 to 15	....
Milling				
Material	18-4-1 high speed steel	0.003 to 0.005 in.	32 to 45	High speed cutters
Rake	10°	per tooth	65	Carbide cutters

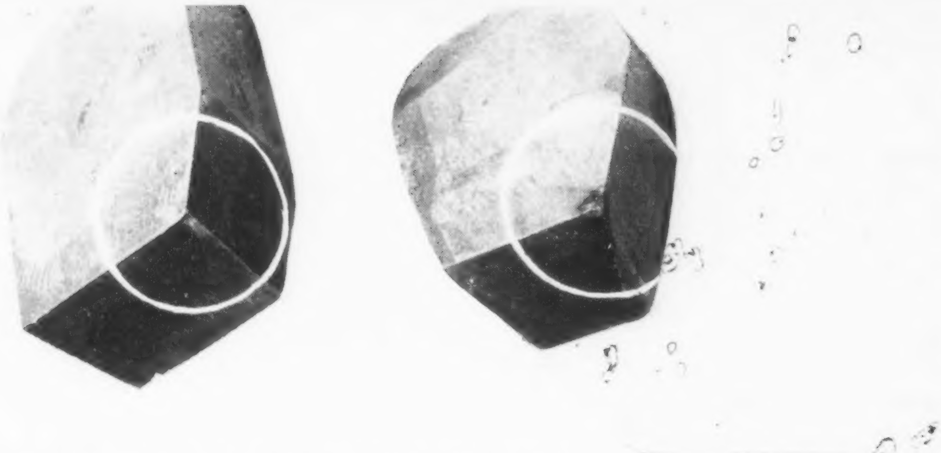


FIG. 17—Effect of carbon content of Fe-Cr alloy on tool life of K-8 carbide tips. Tool on left removed 470 sq in. of the low carbon alloy, micro at left. Tip on the right shows micro of high carbon alloy and condition of tool edge after removing but 25 sq in. of metal. Tests were run at 150 sfpm, 0.0035 ipr feed and 0.015 in. depth of cut. Courtesy Westinghouse Electric Corp.

grinding oils should not be used. One company found quite by accident that a regular rust inhibitor used full strength or diluted with water served as an excellent coolant for rough grinding.

Sulfurized cutting oils are generally used with satisfactory results for turning, drilling, tapping, milling and broaching. In the case of cobalt bonded carbide tools, these oils may cause pitting, however, in which case water soluable oils or other coolants should be used. CO_2 coolant has given excellent results in broaching and turning operations and are recommended for these operations where possible.

One interesting fact regarding machining of forgings is that grinding and drilling cost often soar out of sight when the as received forging is harder than Rc-36. Most titanium forgings are delivered at hardness between Rc-30 to 40. So far, best machinability of such parts has been found between Rc-30 to 36.

Part II, covering melting, casting, sponge making and raw materials will appear in next week's issue of The Iron Age.

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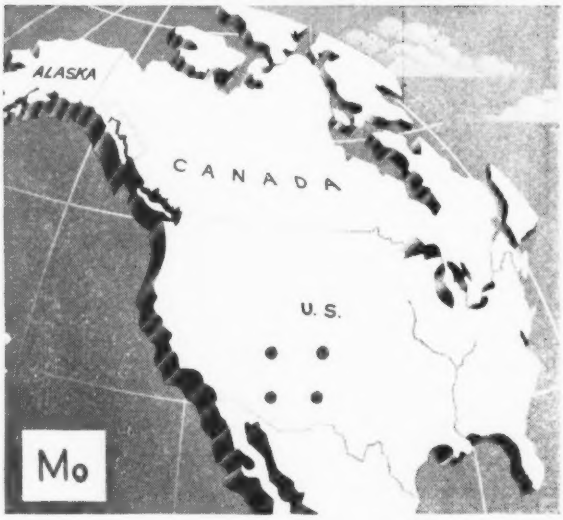
Molybdenum

With a siliconized coating it stands up under 3200°F, shows promise for use in jet engine and electrical applications.



Principal U. S. Raw Material Sources.

Uses: While this report deals with molybdenum as a pure metal or alloying base, it must be remembered that the current uses of the metal, as such, represent only a small fraction of the total production. Nearly 90 pct of the 32 million lb of molybdenum products shipped annually is consumed by the steel and iron industry as ferroalloy. The remaining 10 pct is divided among the electrical, chemical, and ceramic industries.

Molybdenum can be formed by rolling, swaging, forging, drawing, bending, stamping, machining, brazing, and welding. Such basic forms as wire, rod, sheet, plate, bar, seamless tubing, and sintered shapes are available. At present, much of the wire is consumed in the electrical and electronics industry to make heaters for furnaces and supports for vacuum tube components. Sheet is used to make plates and grids for vacuum tubes, radiation shields, and furnace "boats." Seamless tubing is used in the chemical industry. Molybdenum rod finds application where glass-to-metal seals are needed and is also made into resistance-welding electrodes and heavy duty contact breakers.

Commercially produced alloys include those with tungsten and with nickel, as well as powder-metallurgy compositions containing silver, copper, or graphite.

Outlook: Experimental developments, directed toward protection of molybdenum from oxidation, have made high-temperature applications in air feasible. With siliconized coatings the metal may be heated for extended periods to as high as 3200°F. Using nickel or inconel cladding and suitable edge protection, wrought forms may be used in air to 1800-2000°F. As a result of these developments, applications of molybdenum are being extended into the jet engine field with promising result.[1] Further research may yield even better protective methods, which will extend the useful range of molybdenum to higher temperatures.

Welding is a problem with molybdenum. Special apparatus and controlled atmosphere are necessary to obtain good welds. Even so, good room-temperature ductility is not obtained. Welded molybdenum can be formed, however, when heated to redness.

Studies of molybdenum-base alloys have shown them to be superior to the pure metal. The elements aluminum, chromium, columbium, silicon, titanium, tungsten, and vanadium are effective additions. These elements improve the strength of molybdenum at both room and elevated temperatures. The useful high-temperature properties of molybdenum become apparent in tests conducted about 1600°F. Properly protected from oxidation, molybdenum and its alloys are superior to other wrought materials above this temperature. Use of Mo-V alloys in aircraft is increasing.

Availabiltiy: Molybdenum can be had commercially in nearly any desired form. Through newly developed methods of pressing and sintering, bars weighing up to 500 lb have been made. The new method of arc casting has been able to produce ingots weighing up to 1000 lb. Accurate figures of metallic molybdenum production are not available. It is estimated that the production would be from 200,000 to 400,000 lb annually.

Molybdenum concentrates mined in the U. S. will provide about 38 million pounds of molybdenum in 1952. This amount will continue to increase and should rise to 51 to 56 million pounds in 1953. Imports amount to about one-half per cent of the total, but are exceeded by exports.

As of 1944, about 90 pct of the known commercial reserves remained. Based on the 1935-39 average production rate (22,000,000 lb), this would last for 420 years. At the current (1952) rate of about 36,000,000 pounds, the expectancy

FACTS ABOUT MOLYBDENUM

Discovered	1781
First prepared in ductile form	1910
Density	10.2
Melting Point, deg. F	4760
Tensile strength, wrought	85-100,000 psi
Tensile elongation	30-20 pct per in.
Oxidation resistance	forms volatile trioxide above 930° F
Corrosion resistance	HF, HCl

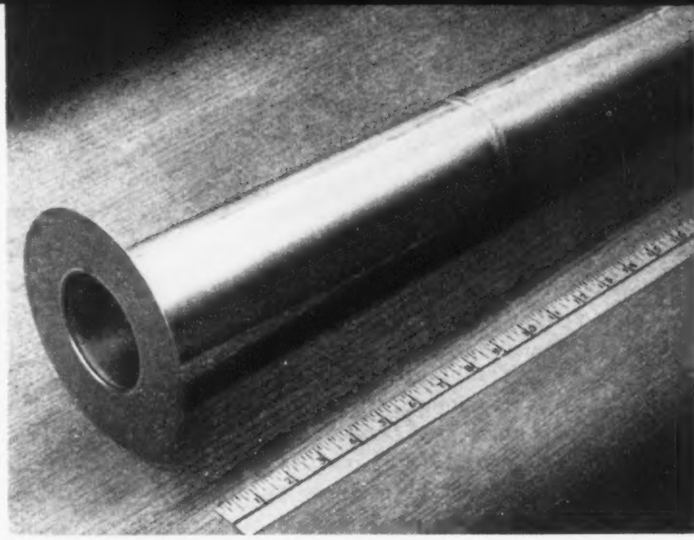
would be about 260 years. Future discovery of new sources, plus extraction of submarginal ores, could add another 60 to 300 years to this figure.

Supply vs. demand: The demand for molybdenum, especially as the ferroalloy, exceeds production. This is a natural result of the stepped-up production of steels and cast irons for military use. In addition, the expanding role of molybdenum as a basic ingredient in high-temperature alloys is increasing the demand. It is expected that sizeable quantities of the metal and its alloys will be needed in jet and rocket manufacture, and that non-military consumption will be restricted for some time to come.

MESH woven from 0.002-in. molybdenum wire, product of Fansteel Metallurgical Corp. This mesh is used in a special type of electronic tube.

Price and suppliers: The arc-cast product and wrought shapes are obtainable from Climax Molybdenum Corp., New York. Sintered bar and wrought shapes are available at Fansteel Metallurgical Corp., North Chicago, Illinois and from Westinghouse Electric Corp., Bloomfield, New Jersey, and East Pittsburgh, Pa. It is understood, also, that General Electric Corp. can supply powder and wire.

Price is governed by shape and supplier. In general, powder can be obtained for $3 to $12.50 per lb; ingots for about $10 per lb; wire from $7.50 to $15 per lb; seamless tubing, sold by the inch, costs up to $6 per inch for ½-in. O.D., 0.09-in. wall; and other wrought shapes up to $60 per lb.



WELDED molybdenum tube, flanged at one end, closed at the other, used in reaction with iodide vapors at high temperatures. Molybdenum is the only commercially available metal that will withstand this corrosive condition. Photo courtesy Fansteel Metallurgical Corp.

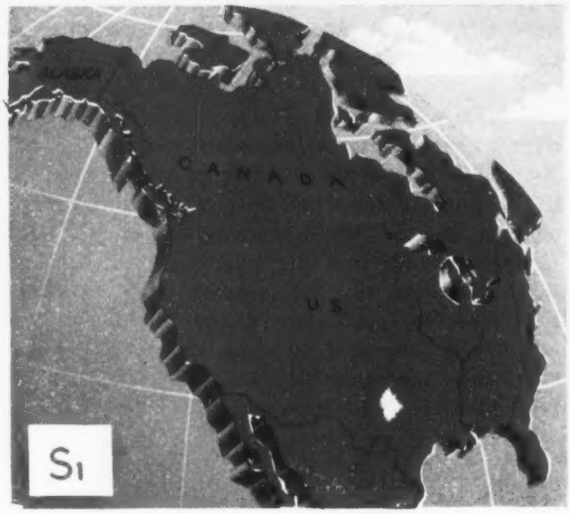
Source: The principal minerals containing molybdenum are molybdenite (MoS_2) and wulfenite ($PbMoO_4$); molybdenite being the more important. The largest commercial source of molybdenite is at Climax, Colo., where about 50 pct of the U. S. supply is mined. Molybdenite also occurs in copper ores, where it is recovered as a by-product. Much of the molybdenite is derived this way at Bingham, Utah; Miami, Ariz.; and Chino, N. M. Wulfenite, containing 39.3 pct MoO_3, is produced in Questa, N. M., and Knaben, Norway.

1. W. M. Boam, "Jet Engines Push Welded Molybdenum Study" THE IRON AGE, July 10, 1952, p. 145.

EXPERIMENTAL molybdenum furnace at Battelle Memorial Institute. Molybdenum bars have been made in weights up to 500 lb, ingots weighing 1000 lb have been cast.

Silicon

Coated on other metals, silicon improves their resistance to acid attack and oxidation . . . Supply is no problem.

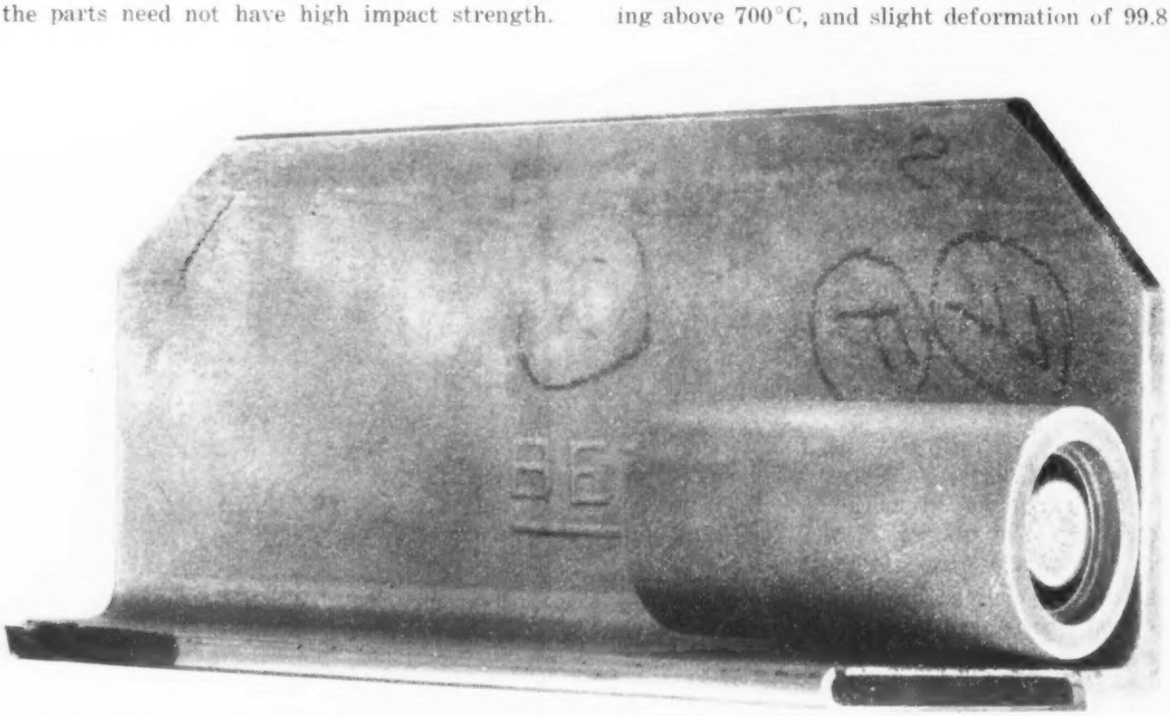


Principal U. S. Raw Material Sources.

Present uses: Silicon is used almost entirely as an alloy. Ferrosilicon containing 50 pct silicon is much used for deoxidizing killed and semikilled steel; the 75 pct grade is used mostly in grey iron foundries, high silicon spring steel and for production of electrical quality sheets. The commercially pure metal, alone or as master alloys, is used in nonferrous alloying. Effective use of silicon (or ferrosilicon) as a reducing medium is exemplified by the production of low carbon ferrochromium by silicon reduction of chrome ore, and production of magnesium by silicon reduction of magnesium oxide. Silicon metal, 97 pct S, is used for the production of silicones.

Outlook: Since brittleness limits use of the massive metal, at least some of silicon's advantages in resistance to oxidation and acid resistance can be utilized by coating it upon formed base metals. Fortunately, many metals can be coated, since volatilized silicon tetrachloride is readily reduced on many metal surfaces by replacement or by reduction in a hydrogen atmosphere. Siliconized steel could replace high alloy steels and castings for some applications under corrosive or high temperature conditions where the parts need not have high impact strength. Siliconized molybdenum gives a particularly effective oxidation resistant surface. Such a coated product, or one modified by other additions may replace platinum and molybdenum furnace windings, and find numerous applications at temperatures up to 3800°F.

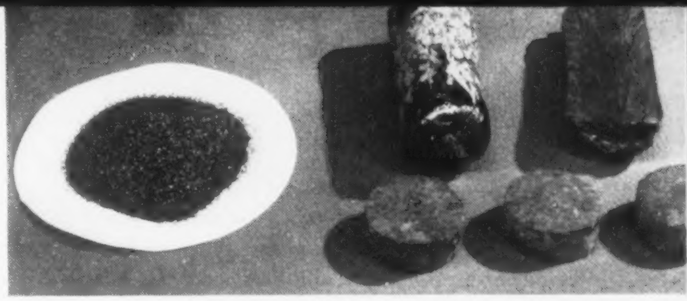
With its lightness, availability, and excellent resistance to oxidation and to acids, silicon would be one of our most important structural materials if it had ductility. Attempts to make ductile silicon, both here and abroad, have failed so far. It is inherently brittle, and its atomic structure would have to be modified to achieve ductility. Some slight evidence has been reported of a form of silicon other than cubic (diamond) existing above 700°C, and slight deformation of 99.8



SILICONIZED rod, tubes and structural iron are test pieces designed to show how materials can be coated fairly easily. It gives them excellent resistance to acids and oxidation. Siliconized steel could replace high alloy steels and castings in some applications.

FACTS ABOUT SILICON

Discovered	1823
First prepared in pure form	about 1918
Density	2.3-2.4
Melting point, deg. F	2600
Mechanical properties	brittle, unworkable
Corrosion resistance	excellent against acids
Oxidation resistance	excellent, even at high temperatures.



SILICON powder and silicon ingot shown in longitudinal section and cross section. Bell Telephone Laboratories, which made this photo, has been studying silicon and other semi-conductors for many years.

pct silicon has been reported at this temperature, but so far this hope for ductility has not materialized practically.

Silicon is a good semiconductor; that is, it has some unusual electrical characteristics like germanium, selenium, and tellurium, whereby, depending on purity, it may be useful in constructing rectifiers, transistors, and various devices of utmost interest in the electronics field.

The fastest growing use for the pure metal is in the production of silicones. Silicones have opened up a new industrial chemical field potentially as broad as that of organic chemistry. New production capacity is being built to supply the silicone market but could be used to supply the demand for metal if and when it arrives.

Figured on a volume basis, silicon is one of the cheapest of the metals. Note that it is somewhat lighter than aluminum. It deserves more attention that it has received in the past.

Supply vs demand: Plentiful supply. Demand for the commercially pure metal is still very light.

Price and suppliers: Silicon metal, 97 pct grade, is currently 20 to 25¢ per lb. The 99.7 pct grade (chemically purified) is about $18 to $20 per lb. Extremely high purity silicon is available on special request, and prices are quoted individually. The main suppliers are Electro Metallurgical Co., a division Union Carbide and Carbon Co., New York, and Vanadium Corp. of America, New York.

Source: Everywhere, U. S. A. It is the most abundant metal in the earth's crust.

Selenium

With electronic applications growing, the problem is to produce more of this scarce metal, perhaps from plants.

Present Uses: The glass industry has been a large user because of the ability of selenium to decolorize or neutralize normally greenish tint from iron contamination; hence it produces a clear, white glass. Of large and rapidly growing importance is the varied field of usefulness of selenium in the electronics field. In rectifiers to convert alternating to direct current and in photosensitive devices, selenium and its compounds find widespread use in the radio-television industry and elsewhere.

Metallurgically, selenium is of minor importance as its properties make it unsuitable for use as the massive metal and general alloying. However, small amounts added to some metals, particularly stainless steel and copper or copper alloys, aid machinability. As a protective coating, the only notable example has been the use (particularly in Europe) of a thin surfacing of selenium on magnesium to reduce the attack of sea water or salt spray.

Outlook: Applications, particularly in electronics, are constantly increasing and the problem is to get more metal. Many old as well as new uses are dormant or curtailed because of limited supply or present high cost.

Availability: Selenium stocks are at their lowest level in years; price has gone up sharply. Total production in the U. S. and Canada is approximately 1 million lb per year, with no significant increase in prospect unless new sources are developed. Possible sources of increased supply include: (1) Recovery of selenium from copper ore now smelted but not electrolytically refined; (2) better recovery in plants now producing selenium where only about one-third of the selenium in copper ore may be eventually recovered; (3) recovery from the sulfur pro-

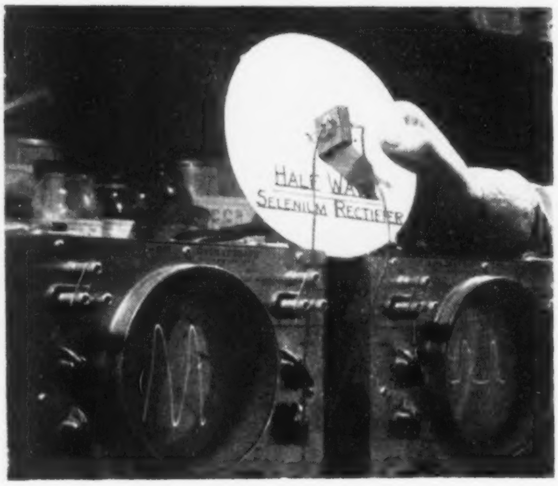
FACTS ABOUT SELENIUM

Discovered	1817
First commercial use	about 1905
Density	4.8
Melting point, deg. F	430
Mechanical properties	brittle, unsuited for structural purposes.
Electrical properties	good semiconductor, photo-sensitive.
Corrosion and oxidation resistance	not outstanding

Selenium (continued)

duced in the roasting of pyrites (one company could recover 40,000 lb per year from such a product) if a way could be found to do it; (4) exploitation of some minor deposits that contain selenium but are not now mined; and (5) by growing selenium in certain seleniferrous soils, particularly in the Dakotas. Seleneium accumulator plants of the pea family are known, and others may be developed. These plants have been known to contain up to 1.5 pct selenium.

FARMING for selenium is a possibility. Plants like this *Astragalus Racemosus* (which is commonly called vetch) contain selenium. In certain areas, the plant could yield many pounds of the metal per acre. Photo courtesy South Dakota Experiment Station.



SELENIUM demand tops supply by some 200 pct because of fast growing new uses, like this experimental half wave rectifier developed by Battelle engineers.

Supply vs. Demand: Demand tops supply by at least 200 pct.

Price and Suppliers: Present price is $3.50 per lb and up, depending on purity. Suppliers include: American Smelting & Refining Co., American Metal Co., Anaconda Copper Co., and Canadian Copper Refiners, Ltd.

Source: At present the sources are the slimes from electrolytic copper refineries and some secondary metal recovered from selenium rectifier scrap.

XEROGRAPHY (zee-rog-ra fee) is a direct positive printing process which reproduces by direct contact in one operation. A thin layer of photoconductive selenium powder takes the place of a silver emulsion. This photo, made during work at Battelle, shows one step in the process, transfer of image from plate to paper.

Vanadium

Its electrical characteristics may open new fields . . . Corrosion resistance and spring behavior suggest other new uses.

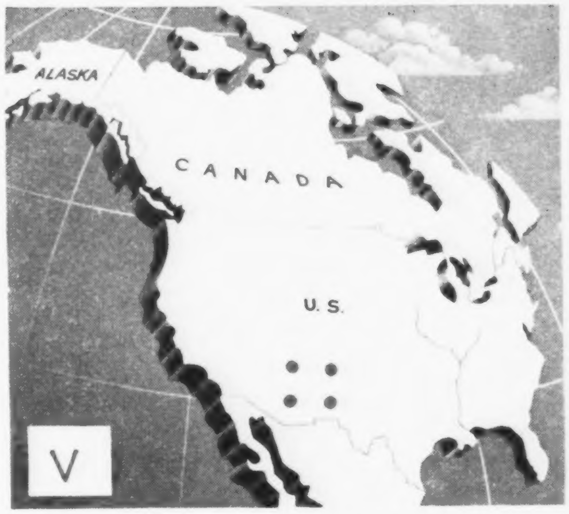
Present Uses: Ferrovanadum, containing 30 to 55 pct vanadium, comprises about 90 pct of current consumption. It is used in alloy and tool steels. The use of metallic vanadium, alone, at present is limited largely to alloying with gold in dental alloys, copper and bronzes (such as for aircraft propeller bushings), and with aluminum for airframe construction. It serves as a strengthening and stiffening agent in these alloys.

Pure vanadium can be formed quite easily into rod, sheet, or foil. Its susceptibility to contamination from oxygen, hydrogen, and nitrogen, requires that hot fabrication be performed in a protective atmosphere, or by enveloping the metal in a sheath. It can be machined, stamped, pressed, ground, extruded, rolled or forged and welded in an argon atmosphere using the Heliarc process. Pure vanadium is used by A.E.C. but further information in such applications is classified.

Outlook: The outstanding characteristics of vanadium are its combination of resistance to marine-atmosphere corrosion and its high modulus-density ratio (3.7 million). The pure metal may find appplications where spring behavior and corrosion resistance are desired. New applications for vanadium will have to overcome two drawbacks, its high cost and its poor oxidation resistance at high temperatures.

One use which is apparently developing for vanadium is as an alloy with titanium and molybdenum. In the case of titanium, vanadium has the property of stabilizing the beta phase, thus tending to produce an improved alloy for structural use.

Vanadium has some electrical characteristics which may open new fields. It has been found useful as a filament wire in vacuum tubes due to its high temperature strength characteristics, and it demonstrates a good thermo-electric potential with platinum. It also has some unusual electrical-resistance, temperature characteristics.



Principal U. S. Raw Material Sources.

Availability: Ductile vanadium is now available. A major producer has stated that about 100 lb a day can be furnished on reasonable notice. Production facilities could be increased rather rapidly, if necessary.

Supply vs demand: The vanadium situation is good. Should the need rise, the output of vanadium could be stepped up strongly. Even during World War II, vanadium was not put on price control.

Price and suppliers: Ductile vanadium remelt stock is available at about \$30 per lb, and less in comparatively large amounts. Semifinished plate, 3/8 x 3 x 10 in., cost about \$60 per lb. High purity powder is currently available at \$1.50 per gram. Ferrovanadium sells for about \$3.00 per lb of contained vanadium. Among suppliers of common forms of the ductile metal is Electro Metallurgical Co., a division of Union Carbide & Carbon Corp.; or high purity powder is Westinghouse Electric Corp. (Lamp Div.); and of vanadium alloys and crude metal is Vanadium Corp. of America.

Source: Vanadium-bearing ores occur mainly in the western United States, the Peruvian Andes and in northern Rhodesia and Southwest Africa. The metal is relatively more abundant than copper or tin in the earth's crust, and about the same in abundance as zinc and nickel. In recent years, about three-fourths of the vanadium used by the United States has come from the Colorado Plateau region. Carnotite and roscoelite, the two most frequently encountered ores, occur in low-grade deposits (from 1 to 2 pct vanadium). In addition, vanadium occurs in complex ores in both western and eastern United States. Vanadium is imported largely as concentrates and the pentoxide from Peru, and as flue dust from Curacao, Netherlands West Indies.

FACTS ABOUT VANADIUM

Discovered	1830
First prepared in ductile form	1927
Density	6.0
Melting point, deg. F	3100
Tensile strength, wrought	31,000 to 155,000 psi
Tensile elongation	17 to 1 pct per inch
Modulus of elasticity	21,000,000 psi
Oxidation resistance	Excellent up to a few hundred degrees F; must be protected from nitride, oxide, and hydride formation at elevated temperatures.
Corrosion resistance	good in salt spray, sea water, aqueous alkalis, dilute HCl.

Zirconium

Potential uses include metal-to-glass seals, corrosion resistant jobs . . . AEC is now almost the sole zirconium user.

Principal U. S. Raw Material Sources.

Present uses: The chief use of zirconium now is as a material of construction for nuclear-reactor power plants. This is easily understood, since it has good-enough mechanical properties, excellent corrosion resistance, and a very low thermal neutron absorption cross-section (i.e., permeability to slow neutrons). The ability of zirconium to pass through slow neutrons (and thus conserve them for their primary function of maintaining a chain reaction) is exceeded for the metals only by bismuth, lead, and beryllium. The structural performance by these is vastly inferior to zirconium.

The uses of ductile, metallic zirconium in nonnuclear applications are less important tonnagewise. These uses are based for the most part on zirconium's excellent corrosion resistance. The resistance to HCl is exceptionally outstanding, and is exceeded only by the precious metals and tantalum. Thus, uses in handling HCl where good heat transfer is required, such as in condensers, boilers, etc., are clearly a field of application. Zirconium is also very good in resisting alkali corrosion, but so are silver and nickel, and it is doubtful if many applications in this field will develop.

A long-time use which consumes a relatively small amount of zirconium is as a getter in electronic tubes. Besides cleaning up residual gases, zirconium can be used as a structural member, thus serving a twofold purpose. Zirconium has potential uses in metal-to-glass seals as a result of its low linear coefficient of thermal expansion, and in electrolytic condensers.

Outlook: Expanded utilization of zirconium in nuclear energy applications is a certainty. The Carborundum Metals Co., Inc., Akron, New York, has been formed recently to produce 150,000 lb of zirconium sponge per year for the AEC. Foote Mineral Co. and the Bureau of Mines at Albany, Oregon, also are zirconium producers. Together with expanded production and lower price, nonnuclear consumption of zirconium should be appreciable. The main outlet will be in corrosion-resistance applications.

Availability: The total production of ductile zirconium is classified information, since nuclear energy requirements are involved. This causes some uncertainty in the amount of zirconium that can be released to nonnuclear uses. Availability might be best stated this way: Sufficient ductile zirconium is available to take care of anticipated demand at the present high price.

Supply and demand: The U. S. Atomic Energy Commission has priority on all present production.

Price and suppliers: The price of the metal depends to a considerable extent on the form in which it is furnished. Foote Mineral Co. sells iodide or crystal-bar grade zirconium in as-deposited form for about $65 per lb. The base prices for fabricated forms are $200 per kilo $91 per lb) for swaged rod, $289 per kilo ($131 per lb) for sheet, and $327 per kilo for wire. Prices for smaller sizes than the base are generally higher. TAM's base price for the zirconium sponge and briquettes is $10 per lb. For fabricated forms the base prices are reported to be $27 per lb for sheared plate (3/16 to ¾ in.) and hot-rolled round or square bar (¼ to 3 in.), $28 per pound for hot-rolled strip (0.09-0.1871 in. by 10 in. maximum with 12-ft maximum length), $35 per lb for cold-rolled strip, and $32.50 for wire. Finer gauges are higher priced.

The only "open market" domestic producers of

FACTS ABOUT ZIRCONIUM

Discovered	1789
First prepared in ductile form	1925
Density	6.5
Melting pointa, deg. F.	3325
Corrosion resistance	HCl, NaOH

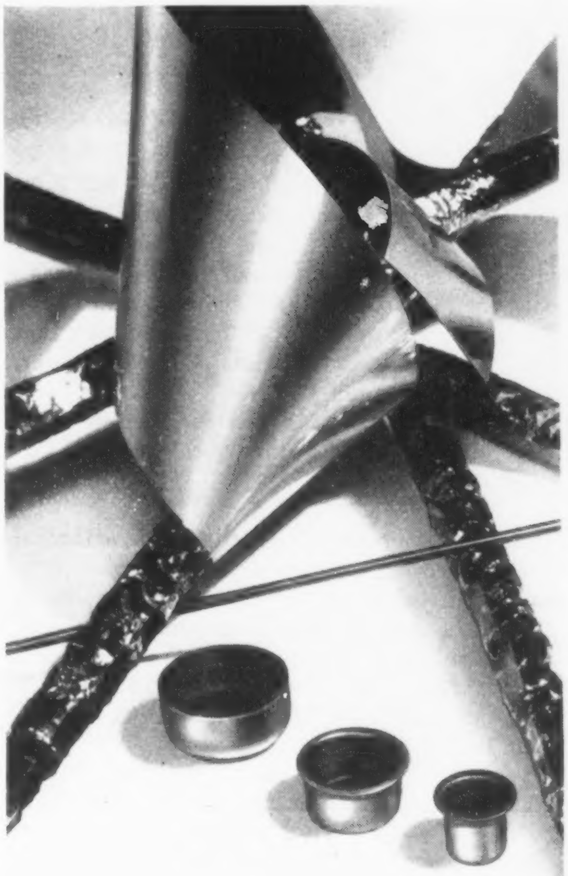
	Crystal Bar	Sponge
Tensile strength, psi	30-40,000	50-55,000
0.2% offset yield, psi	35-45	35-45
Reduction in area, %	15-20,000	25-35,000
Elongation %	25-35	25-30
Modulus of elasticity	13 x 10	....

ductile zirconium at the present time are the Foote Mineral Company for crystal-bar grade and the Titanium Alloy Mfg. Div., National Lead Co. for sponge-grade zirconium. Murex, Ltd., a British concern, also produces ingots and fabricated forms from sponge zirconium.

Source: The chief zirconium mineral is zircon (zirconium silicate), which comes from beach-sand deposits. Almost half of the U. S. consumption comes from Florida beach sands. Imports of zircon are from Travancore, India, and Australia. The availablity of zircon appears excellent. Heavy imports are the result of excellence and cheapness of foreign ores, rather than a limited domestic supply. Baddeleyite, a zirconium dioxide ore, comes from Brazil and is less important industrially.

Extraction: Two chief processes: the Kroll process of magnesium reduction of the tetrachloride, and the deBoer process of thermal dissociation of the iodide. Much less important for the extraction of ductile metal is calcium hydride reduction of the oxide. In current practice, Kroll is the primary extraction method. If further purity, with associated higher ductility and better corrosion resistance, is desired, the Kroll metal is refined by converting to the iodide and then to the metal in the deBoer process. Oxygen and nitrogen are elminated by the deBoer process. DeBoer can be used as a primary process, too, if the starting material can be iodinated, such as zirconium carbide.

NUCLEAR REACTORS are principal users of zirconium today because it passes through slow neutrons, thus conserving them fcr their prmary function of maintaining a chain reaction. Photo at Foote Mineral Co. plant shows engineer holding a zirconium crystal bar. Background shows iodide deposition units.



IODIDE ZIRCONIUM crystal bars and fabricated material, products of Foote Mineral Co., show excellent, ductility of metal now widely used by Atomic Energy Commission because of good nuclear cross section.

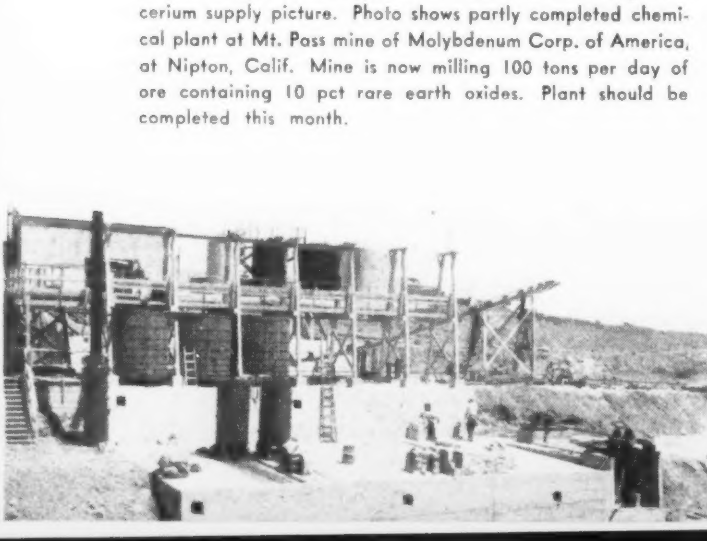
Cerium

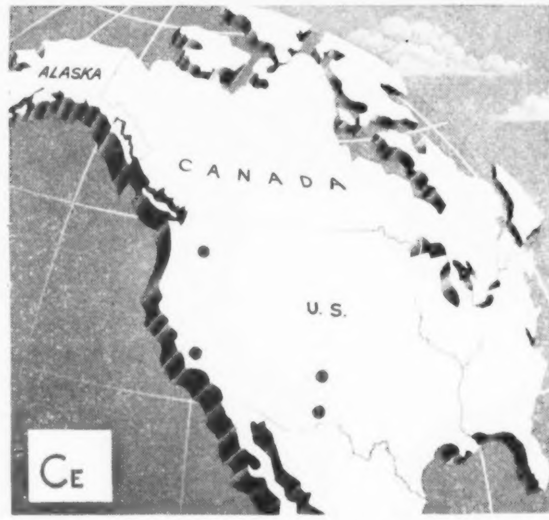
Research shows good possibilities for alloying cerium with the light metals . . . Its use in steelmaking is also promising.

Present uses: There are virtually no uses for pure cerium metal, since the difficulty in isolating the metal, plus the lack of information as to its properties, has handicapped its development. Principal current uses are: (1) As a decolorizer in the glass industry; (2) used with titanium to produce a yellow color in glassware; (3) as an oxide, as an abrasive in glass polishing; (4) as an oxide, cerium is used as an opacifier in certain types of porcelain enamel; (5) for lighter flints, principally as ferrocerium (a mixture of rare earths and iron); (6) as a part of a rare-earth mixture in cores of carbons for high-intensity carbon arc lamps; and (7) most recent use, still in development stage, is additions in steel manufacture. Stainless, tool steel, alloy steel, and electrical-grade steels appear to show beneficial results after additions of lanthanum-cerium-didymium group compounds. Rare-earth additions in the ladle apparently have some desulphurizing effects. "Cerium" additions to cast iron also effect fluidity and hot workability, and resistance to oxidation in certain applications.

Outlook: The interest and support of research in techniques for isolation of rare metals by the AEC has greatly increased the knowledge in this field of metallurgy. By-product production of cerium from monazite will probably increase the available supply. The newly-discovered bastnasite locality, while presenting difficult recovery problems, definitely places cerium in better future supply. Alloying research shows numerous possible applications with the light metals and other nonferrous metals, as well as in steel metallurgy. As soon as more pure metal becomes available, new uses should follow for cerium and other members of the rare earths.

RECENT FIND in California is expected to change the cerium supply picture. Photo shows partly completed chemical plant at Mt. Pass mine of Molybdenum Corp. of America, at Nipton, Calif. Mine is now milling 100 tons per day of ore containing 10 pct rare earth oxides. Plant should be completed this month.





Principal U. S. Raw Material Sources.

Availability: It should be remembered that cerium is more abundant in the earth's crust than such "common" elements as antimony, bismuth, cadmium, mercury, tin, and tungsten. The term, "rare earth," is of historical significance in that the pure metals were difficult to produce in the pure state. The current supply situation does not justify its literal translation.

Supply vs demand: Current supplies are rather tight, but adequate. Indications of increasing supply are strong.

Price and suppliers: 90-98 pct grade, $12 per lb; low-iron misch metal, $4.50 per lb. Rare Earths, Inc., Paterson, N. J.; Lindsay Light & Chemical Co., West Chicago, Ill.; Cooper Metallurgical Associates, Cleveland; Research Chemicals, Inc., Burbank, Calif.; The Maywood Chemical Works, Maywood, N. J.; Cerium Metals, Inc., New York; General Cerium Co., Edgewater, N. J.; New Process Company, Newark, N. J.; Molybdenum Corporation of America, New York, N. Y.; and American Metallurgical Products Co., Pittsburgh.

Source: At present, monazite is the principal source of cerium. However, the discovery of a very large deposit of bastnasite, a rare-earth mineral (a fluocarbonate of cerium, lanthanum, and other rare earths), in San Bernardino County, Calif., in April, 1949, will probably change the supply picture. Such deposits are also found in New Mexico.

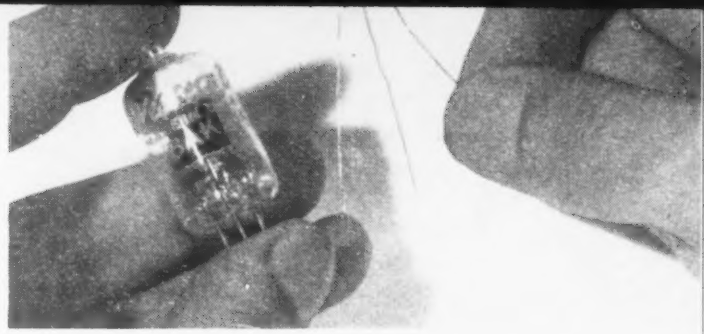
FACTS ABOUT CERIUM

Discovered	1801
Density	6.9
Melting point, deg. F (approx)	1190
Mechanical properties	Soft (42 brinell), ductile
Oxidation resistance	Powder is xyrophoric; massive metal tarnishes in moist air, ignites at 265°F.
Corrosion resistance	Good in sodium hydroxide and in concentrated sulfuric acid.

Note: Cerium is closely associated with other metals of the rare earth family and the term "cerium", is frequently applied to mixtures in which cerium is the dominant element.

Germanium

Miniature radio receivers making use of germanium transistors may have indefinite life, use far less power than tubes.



SPIDERY object at right is a new type transistor, a tiny amplifier invented at Bell Telephone Laboratories. Miniature vacuum tube is shown at left for a size comparison. Transistors have been called the first serious rival of the vacuum tube because they need only about a millionth of the power of a miniature tube and apparently will last indefinitely.

FACTS ABOUT GERMANIUM

Discovered	1886
First prepared commercially in the U.S.A.	1942
Density	5.36
Melting point, deg. F	1725
Mechanical properties	brittle, unworkable
Electrical properties	semiconductor, resistivity increases with purity
Corrosion resistance	Resists strong alkalis, dilute sulfuric and concentrated hydrochloric acids.
Oxidation resistance	good for temperatures up to 1100° F; forms volatile oxide at 1300° F in air.

Present uses: Practically all current production is going into the electronics field where the excellent semiconductor properties of germanium make it invaluable for use as a crystal rectifier or diode for high frequencies, as a transistor or triode to replace the normal function of the vacuum tube, and other devices. With germanium it is possible to make miniature or compact radio receiving sets, for instance, and to get indefinite life with far less energy consumption than when using vacuum tubes. Also, since germanium is transparent to infrared radiation, it can be used in infrared spectroscopy or any optical instruments adapted to use infrared "light."

Outlook: Aside from the very strong and growing demand for germanium in electronics applications, it has properties that could be used in other fields. Germanium glass has an unusually high index of refraction which may make it useful for special applications, as lenses, if the cost does not remain too high. Photo-conductive properties and a very high thermoelectric power may lead to applications.

Metallurgically, the potential use of germanium is limited since brittleness precludes structural uses, and in alloying it generally acts like silicon which is much cheaper. One of the most interesting and possibly useful alloys is the 12 pct germanium-gold eutectic alloy which melts at only 673°F and expands slightly on solidifying. This gives sharp castings. It has been used successfully experimentally for dental inlays. Coatings of germanium over base metals, glass, or ceramic materials are readily made by heating the part to be coated in gaseous germanium hydride.

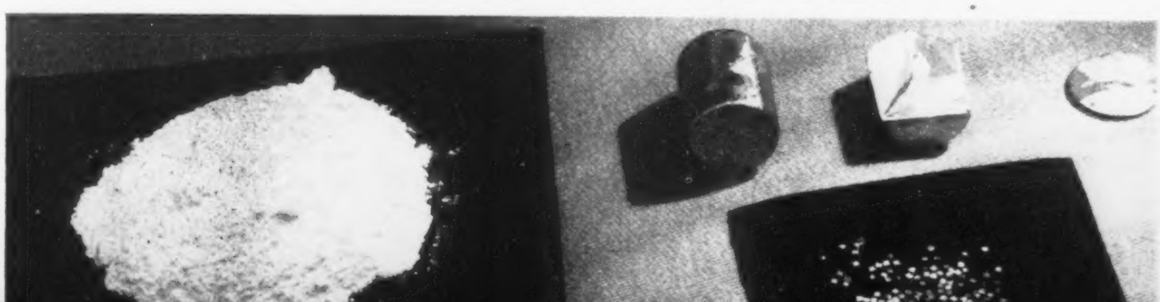
Availability: Need for germanium has stimulated considerable activity both here and abroad in developing new sources. Several zinc companies are now attempting to recover germanium and it is probable that production from this general source may amount to 5000 to 10,000 lb per year within 2 years. Likewise, germanium recovered from Belgian Congo zinc ores may be available soon. A comparatively large supply is expected to develop from southwest Africa (Tsumeb) copper-lead-zinc ores. Recovery of germanium from power plant flue dusts, i.e., volatilized oxide and fine ash in burning coal, is progressing most rapidly in England but not yet on a large scale.

Supply vs demand: The demand currently far outstrips the supply.

Price and suppliers: High purity metal is listed at $340 per lb in lots of over several pounds. However, germanium is largely sold as the dioxide and is reduced to metal by the user. The high purity oxide sells for $140 per lb, or slightly over $200 per lb of metal content. Eagle Picher Co., Cincinnati, is the chief producer.

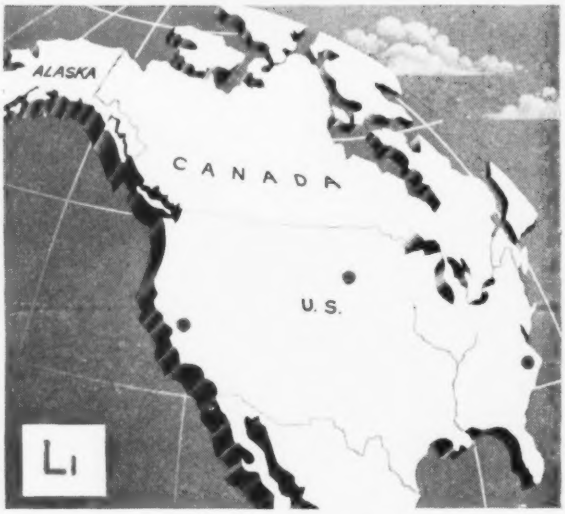
Source: At present, germanium is recovered as a by-product in treatment of zinc concentrates. Potential sources are from germanite in copper-lead-zinc ores of southwest Africa and flue dusts from burning coal containing germanium.

GERMANIUM materials: Germanium dioxide powder, wafers used as electrical devices and ingot with longitudinal section and cross section shown beside it. Photo by courtesy of Bell Telephone Laboratories.



Lithium

Easily melted, cast, formed and welded, its weight is a third that of magnesium but special surface protection is needed.



Principal U. S. Raw Material Sources.

Present uses: Principal uses for lithium are for compounds, as lithium greases that have exceptional water resistant properties and give efficient lubrication at temperatures from —60°F to 120°F, as lithium oxide to get low melting ceramics and promote adherence to the iron base, as lithium chloride in some Cathabar air-conditioning units to control humidity. Several lithium compounds, and the metal itself, are being used in organic synthesis work. The hydride has been used as a convenient and concentrated form of hydrogen to inflate antennae balloons.

Metallurgically, lithium is used only to a small extent as a minor alloying element. Thus, addition of about 10 pct lithium to magnesium converts the hexagonal structure to the more ductile cubic form. Such alloys are in the development stage. Addition of 0.04 pct lithium to a lead-base in Bahnmetall, the German lead-base railway bearing metal, gives hardness that is retained at a relatively high temperature. Some aluminum-welding fluxes contain lithium chloride; other welding and brazing fluxes use lithium fluoride. Lithium chloride is also used as a constituent in some low-melting, heat-treating salt baths.

FACTS ABOUT LITHIUM

Discovered	1817
First prepared commercially	about 1924
Density	0.53
Melting point, deg. F	356
Mechanical properties	very soft, ductile, easily extruded and rolled.
Corrosion resistance	poor, reacts with moisture and forms nitride in moist air. Ignites in air at 400°F.
General	lightest of metals, reactive alloys with most metals.

Outlook: Considering metal applications only, the biggest interest in lithium is to utilize its lightness, since its weight is less than a third that of magnesium, and its floats readily on light oils. The metal is easily melted, cast, formed, and welded. By alloying, it very probably could be made to have reasonably good strength with ductility for structural purposes. The difficulty is to protect it against corrosion by moisture or ignition in air above 400°F. Extensive use then depends upon success in research to develop proper cladding or alloying for surface protection. This is a tough problem but not one that is hopeless.

Use of more lithium in alloying with other metals is promising although the relatively high cost at present is a deterrent. Extended applications of lithium compounds are also favorable.

Availability: With the rapid development of lithium deposits at Kings Mountain there should be ample supplies of lithium compounds, and metal, as needed in the near future. The metal price is high since little is consumed at present.

Supply vs demand: Currently the demand for lithium compounds exceeds the supply, but this is believed to be a temporary condition since production facilities are increasing.

Price and suppliers: 98 pct metal, \$8.85 to \$11.00 per lb. (Lithium chloride sells for about \$1.00 per lb in drum lots, equal to \$6.00 per lb of metal content). Suppliers for metal include Maywood Chemical works, Maywood, N. J., and Metalloy Corp., subsidiary of Lithium Corp. of America, Minneapolis, Minnesota. These and Foote Mineral Co., Philadelphia, Pa., are leading suppliers of lithium salts also.

Sources: The principal ore of lithium, spodumene, is mined particularly in the Kings Mountain district in North Carolina and in the Black Hills of South Dakota. Deposits of spodumene in the former district, carrying 6 pct lithium oxide, are just being developed, but reserves are known to be large enough to supply all anticipated needs for many years. In addition, there are large deposits of lithium ores in Canada, and especially in Africa. Searles Lake in California is estimated to contain 100,000 tons of lithium chloride.

The Road Ahead

The Gargantuan U. S. appetite devours the more common metals and minerals faster each year . . . Our resources are not unlimited . . . How will we meet future demand?

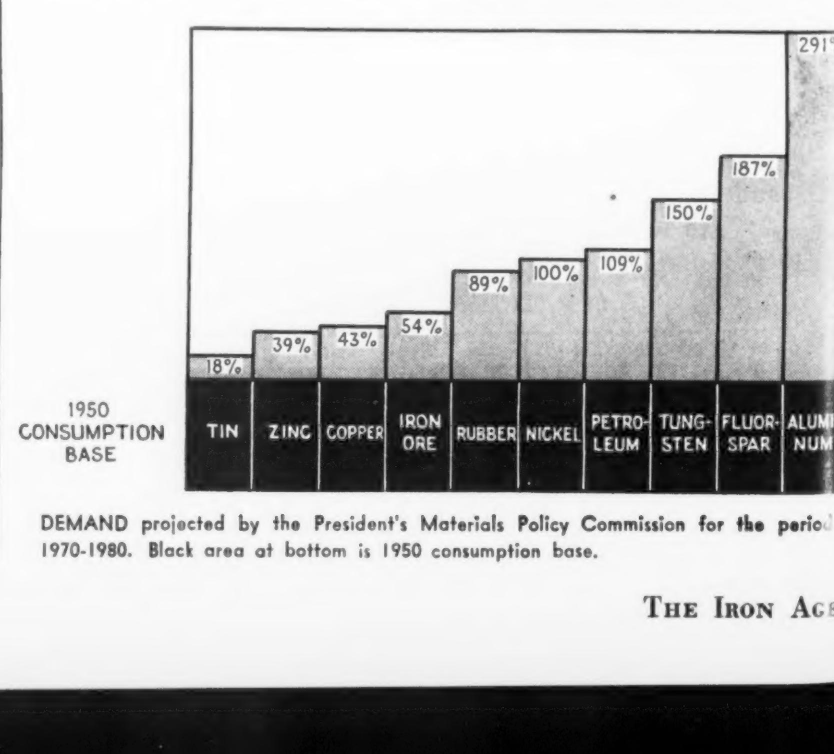
The United States appetite for materials is Gargantuan—and so far, insatiable. At mid-century, over 2½ billion tons of materials are being used up each year to keep the country going and support its high standard of living. With a population of 151 million, each person uses up, on an average, some 18 tons a year. He uses about 14,000 pounds of fuel for heat and energy—warming houses and offices, running automobiles and Diesel trains, firing factory boilers, and hundreds of other tasks. He uses 10,000 pounds of building materials—lumber, stone, sand and gravel, etc.—plus 800 pounds of metals winnowed from 5000 pounds of ores. He eats nearly 1600 pounds of food; this together with cotton and other fibers for clothing, pulpwood for paper and other miscellaneous products mounts up to 5700 pounds of agricultural materials. In addition, he uses 800 pounds of nonmetallics, such as lime, fertilizer, and chemical raw materials.

Such a level of consumption, climaxing 50 years of phenomenal economic progress, has levied a severe drain upon the United States endowment of natural resources. Minerals, forest, soil, and water—all have felt it. A few comparisons between 1950 and 1900 are instructive. In the first 50 years of the twentieth century, United States population doubled. National output in this same time reached five times the 1900 level. The per capita national income for Americans rose from roughly \$325 in 1900, to \$530 in 1925 and \$864 in 1950 (in 1939 dollars).

It took a considerably expanding flow of raw materials to support this growth, but not in the same high proportion. The value of the materials stream* (in constant dollars) rose only half as much as the national output; services were beginning to become a larger proportion of the goods and services that made up this output, and more

* Here defined to include all mineral products except gold, plus agricultural, forest, fishery, and wildlife products consumed in the United States. All statistical statements in these chapters exclude gold. See vol. II, Production and Consumption Measures.

Materials Demand Will Rise Unevenly



DEMAND projected by the President's Materials Policy Commission for the period 1970-1980. Black area at bottom is 1950 consumption base.

value was being added to materials by successively higher fabrication as time went on. It was for such reasons as these that relatively smaller materials values could sustain the more rapidly growing total output.

Even more striking than the increase in the total size of this stream were the shifts in its composition. Our total consumption of agricultural products of all sorts, including food, increased 2¼ times; fishery and wildlife products rose little more, and our total use of forest products actually declined 1 pct. But our consumption of minerals, including fuels, rose to six times 1900 totals. By 1950—in comparison with the year 1900—we were taking from the earth:

- Two and one-half times more bituminous coal.
- Three times more copper.
- Three and one-half times more iron ore.
- Four times more zinc.
- Twenty-six times more natural gas.
- Thirty times more crude oil.

Indeed, there is scarcely a metal or a mineral fuel of which the quantity used in the United States since the outbreak of the First World War did not exceed the total used throughout the world in all the centuries preceding.

The minerals increase is compounded partly out of the needs that rise with growing populations, partly out of a per capita consumption which has increased threefold

This article is abstracted from "Resources for Freedom," a Report to the President by the President's Materials Policy Commission, Vol. I, U. S. Gvt. Printing Office, June, 1952.

in the same time, and is still growing. Fundamentally it reflects the increasing mechanization of modern society. As a result of the turret lathe and tractor, the automobile and airplane, the submarine and tank, the electric washing machine and vacuum cleaner, we have been

We used four times more zinc, three and a half times more iron ore . . . increased mechanization reflected.

Turn Page

The Road Ahead

Continued

Mounting strain on resources most challenging aspect of today's industrial economy . . . Even water short.

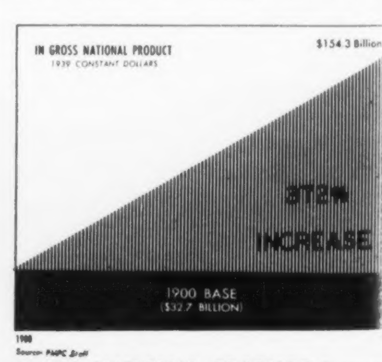
drawing down our most exhaustible resources even faster than the resources that can, in theory at any rate, be renewed. A ton of ore removed from the earth is a ton gone forever; each barrel of oil used up means one less remaining. This mounting strain upon resources that cannot be replaced has become the most challenging aspect of our present-day economy.

"Renewables" strained

But "renewable" resources have also felt the strain. Partly because of soil erosion, even water, once regarded as a "free commodity" of virtually unlimited supply, has become a problem in areas where once it was plentiful.

As a nation we have long lived and prospered mightily without serious concern for our material resources. Our sensational progress in production and consumption has been attributable not only to the freedom of our institutions and the enterprise of our people, but also to our spendthrift use of our rich heritage of natural resources. We have become the supreme advocates of the idea that man and his labor are the most valuable of all, and that inanimate materials are to be used as fully as possible to give men the greatest amount of return for the effort they put forth.

The time has clearly passed when we can afford the luxury of viewing our resources as unlimited and hence taking them for granted. In the United States the supplies of the evident, the cheap, and the ac-



GROSS NATIONAL PRODUCT increased by 372 pct between 1900 and 1950.

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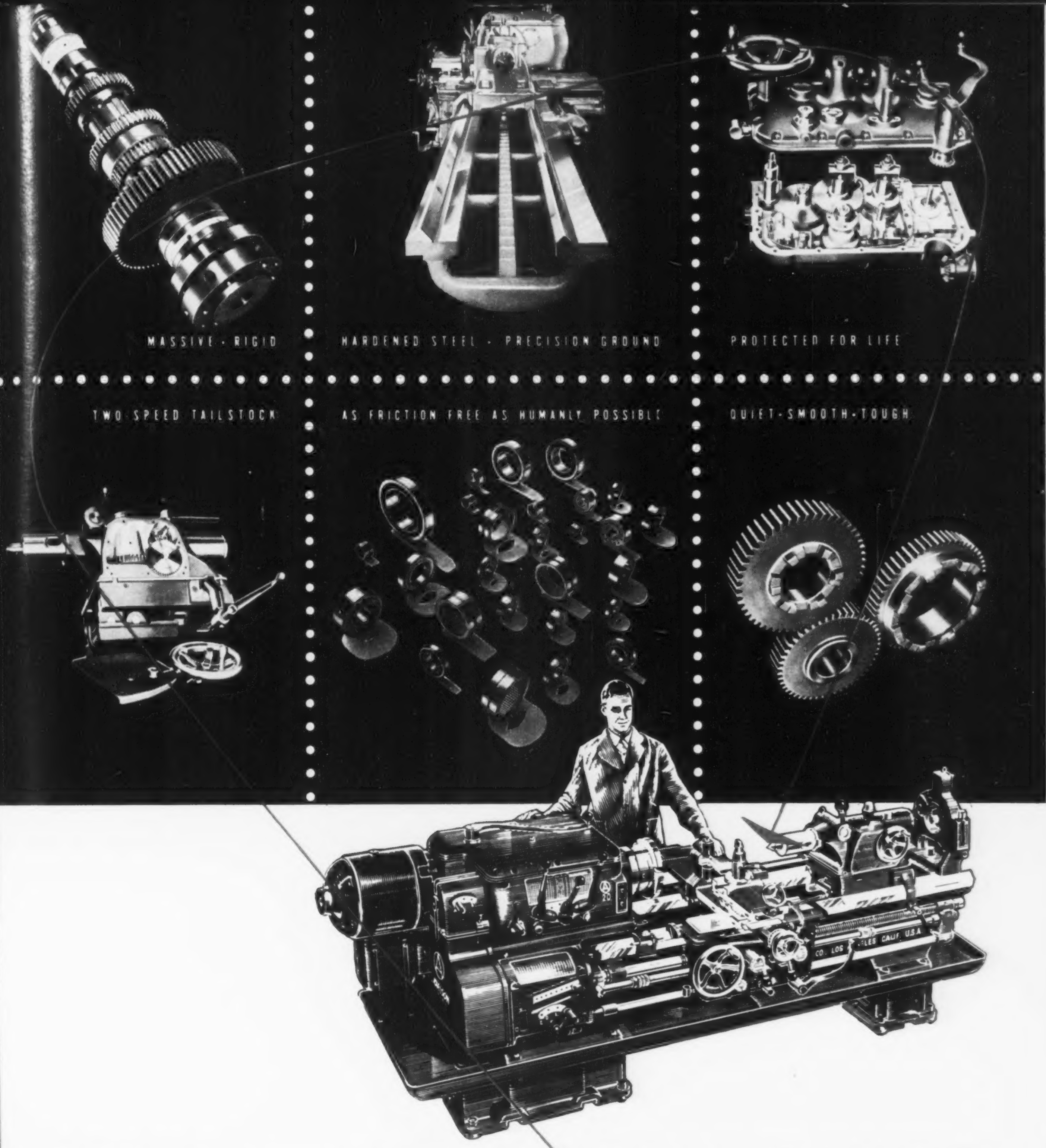
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QUIET - SMOOTH - TOUGH

Continued

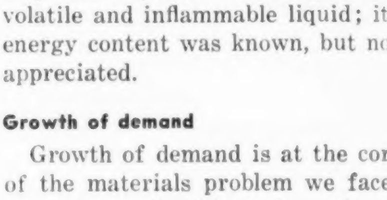
We're skimming the cream from resources as now known . . . New appreciation of materials uses needed.

cessible (chemically and geologically) are running out. The plain fact seems to be that we have skimmed the cream of our resources as we now understand them; there must not be, at this decisive point in history, too long a pause before our understanding catches up with our needs. We are much more supple today in our uses of materials than or ancestors were in the past; but when we consider the number of materials our ancestors did not use, it will become us to remember that frequently they left much unused not because it was undiscovered, but because they did not know what to do with what they knew to exist. Long after petrolem was discovered, refiners threw away what would today be described as gasoline, because it presented to them only the aspect of a dangerously volatile and inflammable liquid; its energy content was known, but not appreciated.

Growth of demand

Growth of demand is at the core of the materials problem we face; it is the probability of continued growth, even more than the incursions of past growth and two world wars, that present us now with our long-range problem. It is mainly our unwillingness to stand still, to accept the status of a "mature economy," that challenges the adequacy of our resources.

In contrast to other industrial nations, we have been able in the past to satisfy the bulk of our materials demand from our own domestic resources, with much to spare for export. Accordingly the United States has used up its resources consider-



MATERIALS CONSUMPTION increase between 1900 and 1950 rose 153 pct.

—The Road Ahead—

Continued

1940's mark crucial turning point in nation's long range materials position . . . Exporter to importer.

ably faster than the rest of the free world. With less than 10 pct of the free world's population and 8 pct of its land area, the United States consumes close to half the free world volume of materials.

Facts of this sort about our past and present raise serious questions about the future. How long can this go on? How adequate are our remaining resources to support future demands against them? What alternatives are available to us for meeting our future needs? We who view the Materials Problem from the vantage point of the United States in 1952 can best prepare ourselves for discerning the future by a brief tracing of the path which has led to the present.

Turning point

The decade of the 1940's marked a crucial turning point in the long-range materials position of the United States. Historical trends long in the making finally came to a climax when the national economy moved just prior to the war from a long period of depression into a period, still continuing, of high employment and production. By the midpoint of the twentieth century we had entered an era of new relationships between our needs and resources; our national economy had not merely grown up to its resource base, but in many important respects had outgrown it. We had completed our slow transition from a raw materials surplus nation to a raw materials deficit nation.

Danger symptoms

The symptoms of this changed materials position are today numerous; we have become the world's largest importers of copper, lead, and zinc, whereas once we were huge exporters. We have begun to meet from foreign sources a sizable and growing portion of our needs for petroleum and iron ore, which long were hallmarks of United States self-sufficiency. We have shifted from net exporter to net importer of lumber. There are today

Turn Page

—The Road Ahead—

Continued

Changing patterns in materials use linked to changing national economy . . . Now consumer nation.

only two metals (magnesium and molybdenum) for which we are not partially dependent on foreign supplies.

The United States has never been completely self-sufficient in raw materials; had we insisted on being so, our economic output and living standards today would be considerably lower than they are. We began as an "underdeveloped" nation with rich resources but a shortage of manpower and capital, and little industry. For a long time we were predominantly agrarian; as late as 1870, we had three farmers for every manufacturing worker. It made good sense for us then, as it does for many less developed countries today, to concentrate on the export of raw materials and agricultural products as the best means of acquiring purchasing power abroad with which to support better living standards and economic growth.

Markets change

With the growth of manufacturing, United States foreign trade burgeoned, and its composition underwent drastic change. As a seller in world markets, we shifted emphasis from raw materials to manufactured goods; as a buyer, we shifted emphasis from finished goods to raw materials. As a result of these shifts, crude materials fell from over 60 pct of our merchandise exports in 1820 to less than 15 pct by 1946-50; conversely, finished manufactured goods rose from less than 6 pct of our exports in 1820 to 52 pct by 1946-50. Opposite changes

POPULATION has set the pace for growth in national economy during half century

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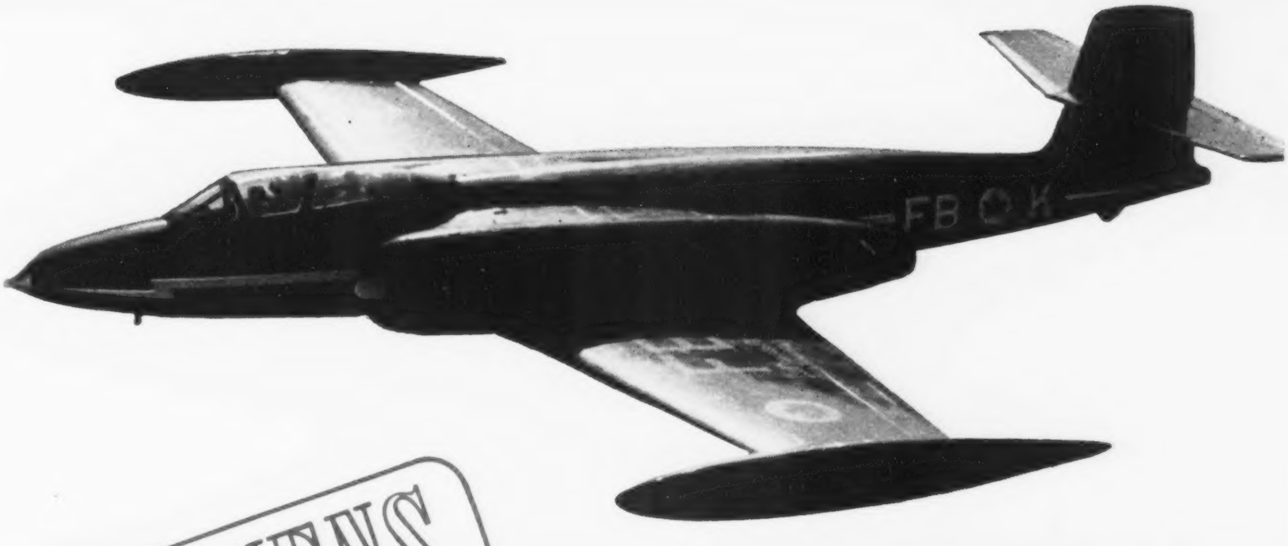

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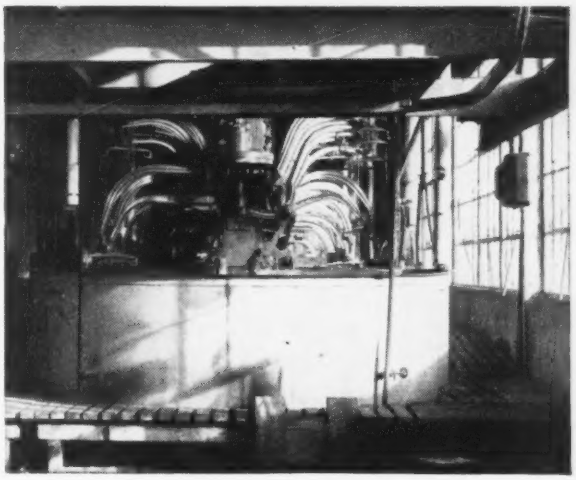

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The Road Ahead

Continued

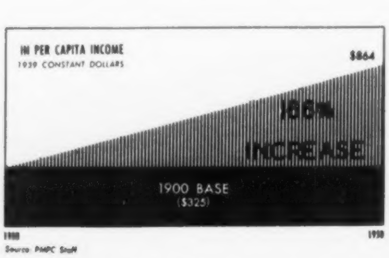
Future demand depends on expansion rate of U. S. and world economy . . . Output may double by 1975

occurred in our pattern of imports.

The inevitable has now come to pass. Whereas for many decades the United States economy produced more raw materials than it consumed and thus had a net outflow of materials to the rest of the world, we seem now to have settled solidly into the position of consuming more materials than we produce.

Control factor

The size of future materials demand, and the adequacy of supplies, will depend upon the rate at which the United States economy and that of the whole free world expands. If we assume for the moment a favorable set of materials supply conditions, the size of our national output by 1975 will depend mainly upon the size of total population and working force, the number of hours worked per week, the accumulation of capital that has by then occurred, and upon the rise in manhour productivity. Taking these various factors into account, this Commission believes it is reasonable to anticipate a rate of growth for the United States economy in the future roughly equal to the past rate of growth, or about 3 pct a year. This means that by 1975 total national output (the total of all our goods and services, known as gross national product, or GNP) would be approximately double that of 1950. Estimates of population range between 180 and 220 million; the Commission has assumed, after consultation with the Bureau of the Census, a population of 193 million



PER CAPITA INCOME, based on a 1939 constant dollar has shown 166 pct rise in 50 years.

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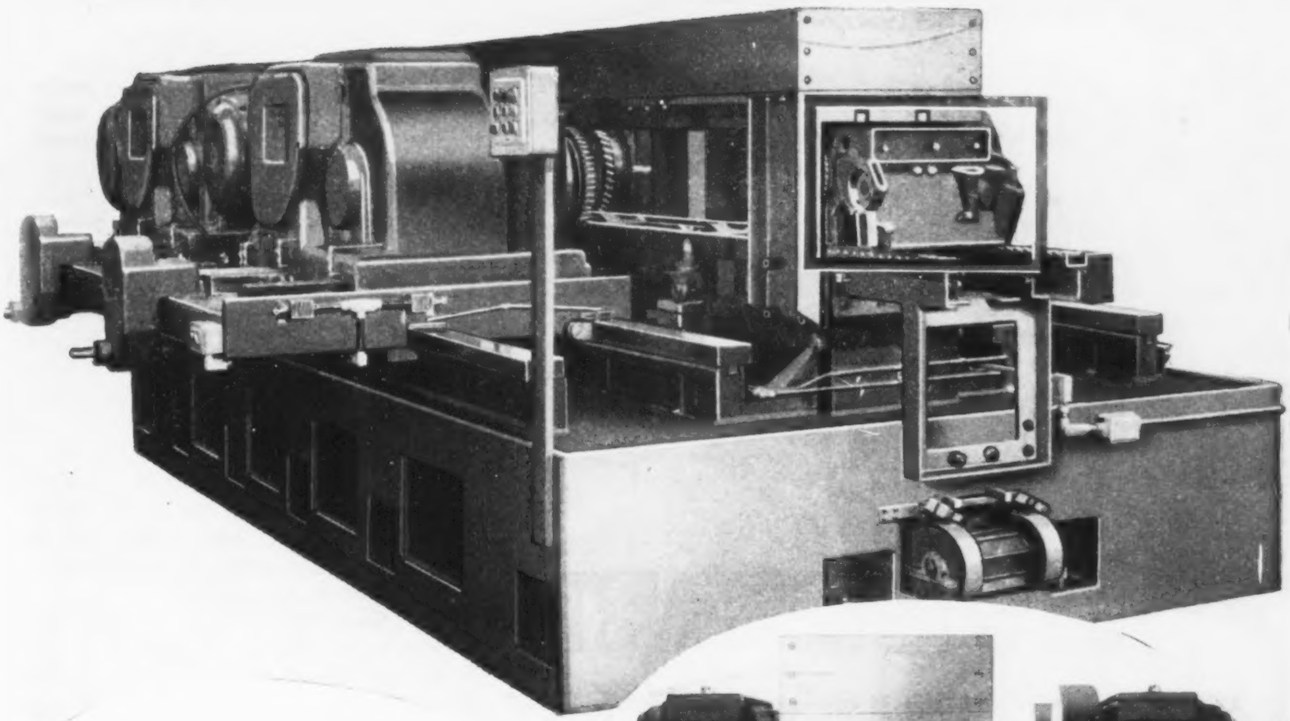

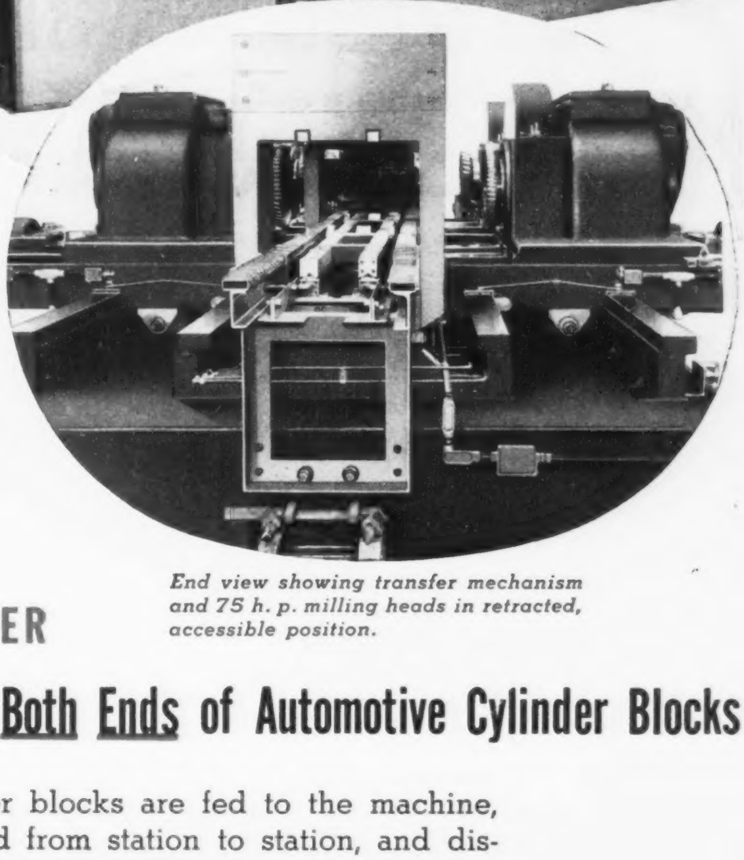

End view showing transfer mechanism and 75 h. p. milling heads in retracted, accessible position.

Future demand for major materials projected . . . Large substitution trends clearly evidenced.

by 1975 and a working force of 82 million, with a work-week perhaps 15 pct shorter than in 1950. These factors imply an annual rise of $2\frac{1}{2}$ pct in production per man-hour against a somewhat smaller past rate of 2.1 pct because it seems reasonable to expect considerably steadier levels of employment and economic activity in the future, in line with the avowed national objective of making major depressions a relic of the past. This does not preclude, however, the possibility of milder fluctuations.

Based upon the foregoing, the Commission has projected the general magnitude of demand by 1970-80 for various major materials. These projections do not predict how much of each material will actually be available and consumed. Instead they are an estimate of what might be demanded *if relative prices of various materials remained the same as in early 1950,* which they are most unlikely to do. Moreover these projections assume no unforeseeable new uses, substitutions, or technological improvements. They are intended solely as a starting point in the analyses of prospective supply-demand conditions and give only a rough measure of magnitudes.

Demands will vary

The demand for various materials under these circumstances is expected to rise quite unevenly, in some cases going up as little as one-quarter, in others rising fourfold or more (see chart). Demands are expected to vary according to main uses with which the materials are associated and to reflect the extent to which large substitution trends of one material for another are already cearly in motion.

Although these projections may look high by today's standards they may well prove too low by tomorrow's; for they reflect in some cases a somewhat smaller annual rate of increase of demand for the future than has characterized the past. Based on past experience, it can be

Turn to Page 304

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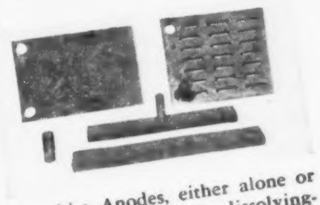

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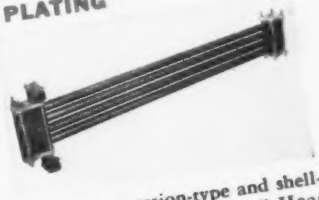

Various immersion-type and shell-and-tube type "Karbate" Heat Exchangers are available to suit capacity requirements.

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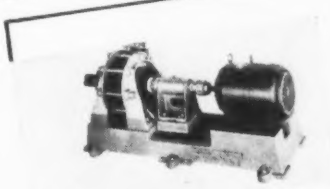

"Karbate" pumps and piping resist sulphuric and hydrochloric acid attack . . . protect solution from contamination.

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Supply-demand factors have strong international influence . . . Projections consider world trade.

expected that considerably less than a doubling of total materials "input" will be required to achieve a doubling of national output. In 1900, for example, each dollar of raw materials cost supported only \$4.20 worth of finish goods and services; by 1950 the raw materials dollar was supporting \$7.80 worth (after discounting for changes in the general price level). Reasoning from this trend it seems probable that somewhere between a 50 and 60 pct increase in the *total* materials stream will be needed to achieve a doubling of total national production in the 1970's, with demand for metals and mineral fuels rising more than this average, agricultural demand somewhat less, and forest products demand considerably less.

U. S. influence

What happens to United States demand and supply will have a strong influence on the materials situation of other nations since many of these materials have international markets, and developments abroad will similarly have their impact in this country. For these reasons the Commission in its estimate of the future has made allowance for other free world demand although projections of foreign demand trend are necessarily even less definite than those made for the United States. These estimates suggest that total free world demand for materials will expand considerably in the next generation and that the United States, although its total consumption of materials will increase greatly, will probably consume a somewhat smaller share of the total supply.

Wide differences

There is room for wide differences of judgment in this difficult area of demand projections, but one point of overriding significance stands out. Whether it is estimated that the demand for a particular material will rise 50 pct, 100 pct, or 200 pct, the central point is that

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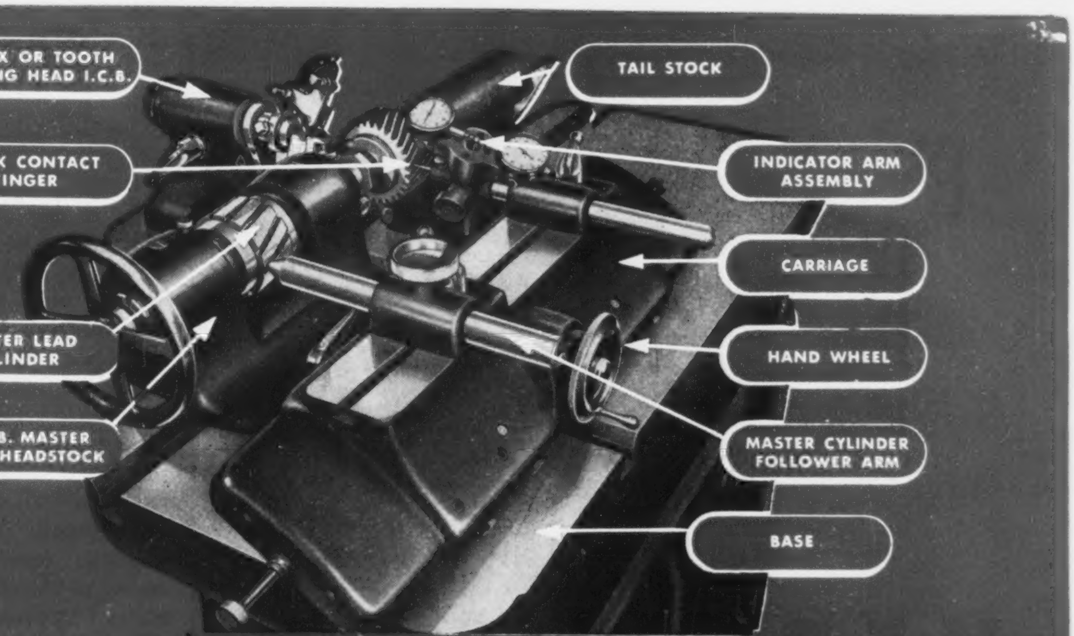

Red Ring Lead Comparator—slide assembly on the right of the work centers with the I.C.B. index or tooth space checking head on the other side.

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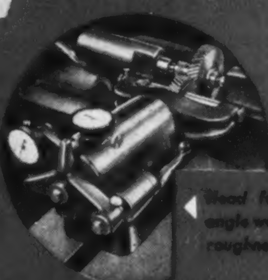

Head for checking helix angle wobble, eccentricity, roughness of roll and size.

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—The Road Ahead—

Continued

Static economy rejected . . . See greatly increased demands underscoring basic materials position.

demand can be expected to rise substantially. This is not always a popular view to espouse. No one feels quite so crestfallen as the host who prepares for a celebration which then fails to occur, and businessmen the world over are certainly more fearful of producing too much of their product than of having a certain amount of unsatisfied demand. Yet economic history certainly records more underestimates of the future than overestimates. Depressions and recessions, historically viewed, become smaller episodes in a longer and more heroic tale. There is no reason to assume that a world which has been growing economically by leaps and bounds for many generations will suddenly become static in this generation. It is this certainty of greatly increased demand for materials in the future that underscores the importance of the fundamental shift in the basic materials position of the United States during the past decade.

Some sunlight

If the United States were forced to live within the rigid structure of its present materials position, its future outlook would be bleak indeed. We would have to meet all future needs from the domestic resources we now have and know how to use. Our technique of using materials would be frozen in its

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"They say their new model will knock your eyes out."

—The Road Ahead—

Continued

U. S. uses only small fraction of total resources . . . Discovery of new uses keeps position strong.

present mold. Each successive year would further deplete reserves, materials costs would rise geometrically, production would shrink and the clock of economic progress would run down.

Fortunately the outlook, although serious, is not as bleak as that. Our materials position is flexible and we have opportunities to improve it along three main lines:

1. *We can get more materials and more energy from our domestic resources by pushing back the technological, physical, and economic boundaries that presently limit the supply.*

2. *We can alter our patterns of using materials by more efficient designs and processes — and by shifting the burden of use away from scarcer materials, toward more abundant ones.*

3. *We can get more materials from abroad, on terms beneficial to ourselves and other free nations.*

Opportunities

These opportunities are both real and promising, but their full benefits will never be realized except by earnest and unremitting effort.

The United States even today makes practical use of only a small fraction of its total resources. Our total resource base, broadly conceived, includes all components of the earth's crust within our borders, together with the atmosphere, water, climate, and the energy forces of nature, but the usable sector of that base is limited by the combination of physical, technological, and economic conditions prevailing at any one time.

As conditions change, the base of usable resources also changes. Past depletion notwithstanding, this nation today has a far broader and stronger usable resource base than ever before, mainly because over the years we have discovered resources and uses unsuspected by our ancestors. The bayberries of Cape Cod and the sperm whales off Nantucket were vital resources to the early inhabitants of Massachusetts.

Turn to Page 310

STANDARDS and SPECIALS by the *Millions*

THE FERRY CAP & SET SCREW CO.

2157 SCRANTON ROAD • • • CLEVELAND 13, OHIO

"SHINYHEADS"

America's Best Looking Cap Screw

Made of high carbon steel — AISI C-1038 — to standards for Full Finished hexagon head cap screws—bright finish. Heads machined top and bottom. Hexagon faces clean cut, smooth and true, mirror finish. Tensile strength 95,000-110,000 p.s.i. Carried in stock.

"HI-CARBS"

Heat Treated Black Satin Finish

Made of high carbon steel — AISI C-1038. Furnished with black satin finish due to double heat treatment. Hexagon heads die made, not machined. Points machine turned; flat and chamfered. Tensile strength 130,000-160,000 p.s.i. Carried in stock.

"LO-CARBS"

Made of AISI C-1018 steel—bright finish. For use where heat treatment is not required and where ordinary hexagon heads are satisfactory. Hexagon heads die made to size—not machined. Points machine turned. Tensile strength 75,000-95,000 p.s.i. Carried in stock.

SET SCREWS

Square head and headless — cup point. Case hardened. Expertly made by the pioneers in producing Cup Point Set Screws by the cold upset process. Cup points machine turned. Carried in stock.

FILLISTER CAP SCREWS

Heads completely machined top and bottom. Milled slots — less burrs. Flat and chamfered machined point. Carried in stock.

FLAT HEAD CAP SCREWS

Heads completely machined top and bottom. Milled slots — less burrs. Flat and chamfered machined point. Carried in stock.

"SHINYLAND" STUDS

All studs made steam-tight on tap end unless otherwise specified, with flat and chamfered machined point. Nut end, oval point. Land between threads shiny, bright, mirror finish. Carried in stock.

CONNECTING ROD BOLTS

Made of alloy steel — heat treated — threads rolled or cut — finished to extremely close thread and body tolerances — body ground where specified. Expertly made by the pioneers in producing connecting rod bolts by the cold upset process.

ADJUSTING SCREWS

Valve tappet adjusting screws — Hexagon head style — to blue print specifications—hexagon head hard; polished if specified — threads soft to close tolerance—points machine turned; flat and chamfered.

SPRING BOLTS

Case hardened to proper depth and ground to close tolerances. Thread end annealed. Supplied in various head shapes, with oil holes and grooves of different kinds, and flats accurately milled.

FERRY PATENTED ACORN NUTS

For ornamental purposes. Steel insert — steel covered. Finish: plain, zinc plated, cadmium plated. Size: 9/16", 3/4", 15/16" across the flats.

Tapped 1/4" to 3/4" inclusive. Cross section of Ferry patented acorn nut, showing how steel hexagon nut fits snugly into shell.

Pioneers and Recognized Specialists, Cold Upset Screw Products since 1907

STANDARDS

carried by

LEADING

DISTRIBUTORS

SPECIALS

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BLUE PRINT

SPECIFICATIONS

WRITE FOR INFORMATION

SEND FOR SAMPLES

Can world provide expanding material flow in "mix" to fit its needs? . . . Richer veins in earth.

as was the buffalo to the plainsmen. It was irrelevant to them that nature had created huge pools of petroleum under the topsoil of Texas, great bodies of iron ore in Minnesota, waterfalls in Washington, and phosphates in Florida. It is equally irrelevant to us today that the candles, the whale, and the buffalo have all but vanished from the scene; but it is of high importance that the resources of the West have been opened up, that the invention of the internal combustion engine has made petroleum a valuable resource, that technology has taught us how to make aluminum from bauxite, and plastics from such abundant resources as coal, water, and air. By discovery, development, and technology, the materials stream which flows from our resources has been tremendously enlarged and its composition vastly altered, while the cost of materials measured in human effort has, until recently at any rate, steadily declined.

Progress speed

The big question now is whether such progress in resource use can continue, both here and abroad, at a rapid enough pace and at a low enough cost to provide us with an expanding flow of materials in a "mix" to fit our needs. No one can be sure, but we do know that we can attack the question from both sides—that of supply, and that of use. In expanding our mix, we can work on supply by finding more of our familiar materials; by using our known resources more fully; by using resources of lower quality; by really renewing our "renewables"; by finding uses for unemployed materials and by synthesizing new substances. No one of these supply possibilities excludes any other; indeed, combinations of these efforts are essential.

Exploration and Discovery. Most major metal discoveries have been made by following surface ore exposures in the mountain regions. By now few of these exposures re-

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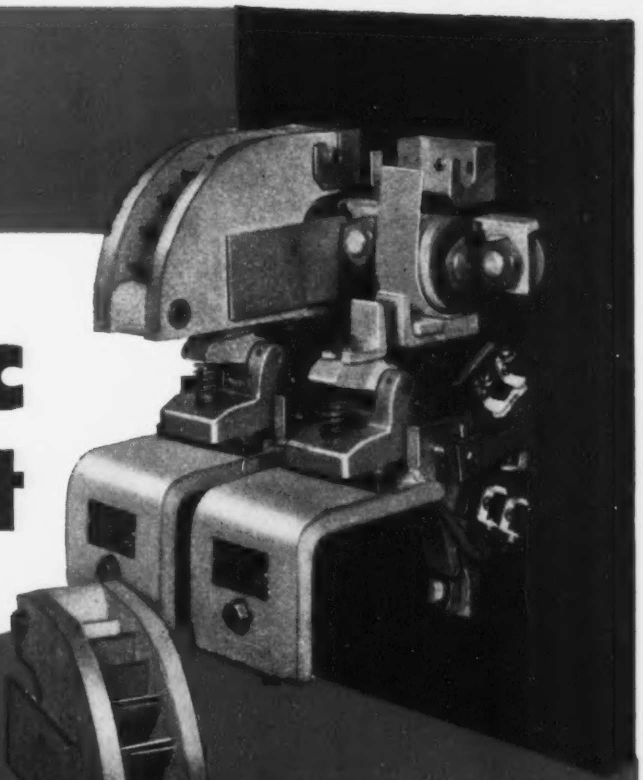
NEW

Fast Arc Blowout

ALLIS-CHALMERS
Mill Type 260 DC
CONTACTOR



Two Type 260 DC Contactors, 150 amp, single pole, normally open, with auxiliary switch. One arc chute has been removed to show control detail. Type 260 DC Contactors with the new Arc Centering Feature are rated 600, 300 and 150 amps at 600-volt maximum.

• Speeds Arc Interruption
• Extends Contact and Chute Life

THIS NEW HEAVY DUTY CONTACTOR offers an *entirely new* principle of arc interruption . . . developed by Allis-Chalmers engineers to meet the exacting needs of industry.

Contact and arc chute life have been greatly extended by an *arc centering blowout*. In centering the arc, increased blowout action and fast interruption results from a combination of thermal convection and magnetic action. Contact erosion is reduced and carbonization is minimized.

Other advantages of the Mill Type 260 DC Contactor include: accessible construction for easy maintenance; ROLLING contact action with no destructive scuffing; design simplicity which has eliminated troublesome linkages, arms and pivots.

The Type 260 DC Contactor featuring the new arc interruption principle has been designed and built to steel mill engineers' specifications. Years of field and factory tests have proved this heavy duty contactor far exceeds NEMA requirements . . . have established it as an efficient, trouble-free performer under the most severe operating conditions. Call your nearby Allis-Chalmers District Office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 14B6505A.

A-3871

ALLIS-CHALMERS

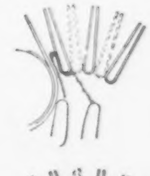
A-C ALLIS-CHALMERS

How Arc Interruption Principle Works

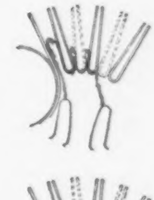
Arc Chute Assembly consists of triangular metal plates with U-shaped segments mounted alternately. Plates are insulated from each other and are placed at right angles to circumference of contact travel.

Metallic segments act as individual blowout coils.

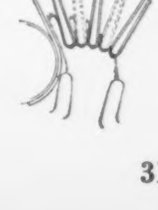
Arc is forced upward along arc runner by blowout coil and impinges on metal segment of arc chute.



As contacts separate further, arc is stretched across an increased number of segments.



Arc rises quickly due to thermal and magnetic action of each individual metal segment.



—The Road Ahead—

Continued

Large part of all basic resources "unharvested" in processing. . . . New low cost methods would help.

main undiscovered in the United States, so diligent has been the search. However, geologists infer that, hidden under a mantle of younger rocks, ore deposits exist as large and as rich as have previously been found in the exposed areas. How soon there would be economical methods and equipment to explore and mine the basement rocks is another matter. Meanwhile, we must improve geophysical and geochemical prospecting methods that are at present in slow development before we can hope to make significant new discoveries of hidden ore bodies.

Fuller use indicated

Fuller Use of Known Resources. In mining minerals we still leave an astounding fraction in the ground and in using mined or harvested materials we frequently throw away large quantities. About 50 pct of the commercial grades of coal, and more than 50 pct of the petroleum in an average pool are left behind in the process of production. Roughly one out of every 10 pounds of copper in ores is thrown on the tailings heap; more sulfur is blown from the smokestacks of industry than is consumed; enough natural gas was wasted in 1950 to supply the gas needs of 11 million of the nation's homes. A considerable fraction of

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"Better report that one to The Iron Age. That's unique for working in the rain."

The Road Ahead

Continued

Virgin timber unused for lack of roads . . . Power sites await development . . . Resources mined out.

"harvested" resources also goes unused: only 65 pct of the average tree that is cut ends up as useful material; millions of tons of agricultural growth — stalks, for example—are lost every year because there is no economical way to use them.

Neglected opportunities

These physical wastes are not necessarily economic wastes, for it frequently costs more to eliminate them than the savings would be worth. But technical advances that will make it profitable to reduce these physical wastes will enormously benefit the nation's materials supply. At present, many profitable opportunities to cut physical wastes are being neglected by industrial companies whose equipment and production methods are outmoded and wasteful, or who have not explored carefully enough the potential profit in waste reduction.

Another type of neglected opportunity is exemplified by hydropower sites which remain undeveloped even though they would pay dividends, or by the virgin timber stands in the national forests of the West which have reached maximum growth but come to no use because roads have not been built to reach them. Full utilization of such resources does not await improved technology; here the missing ingredient is capital to build dams, and access roads.

Location important

Using Lower Quality Resources. The richest grade resources, if not too inconveniently located, are always the cheapest to use. For this reason civilization has always first skimmed the cream of its resources. Yet when forced, we have frequently found that today's use of the second best has advantages over yesterday's use of the best. The newsprint industry, once confined to using northern spruce, can today use a faster growing southern pine which once it could not use at all;

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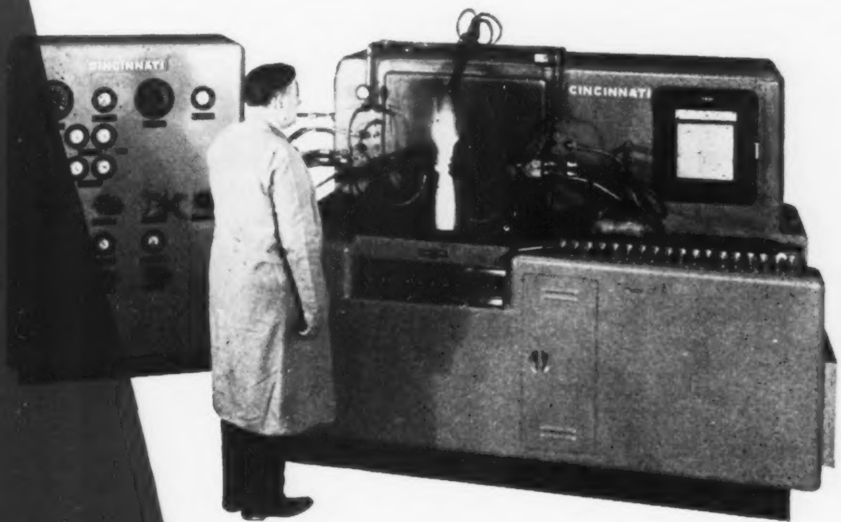

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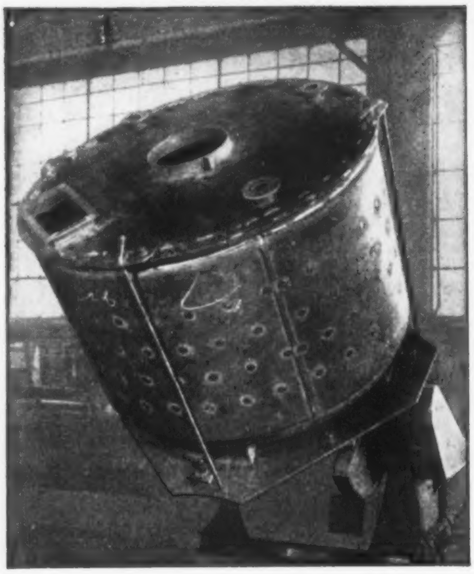

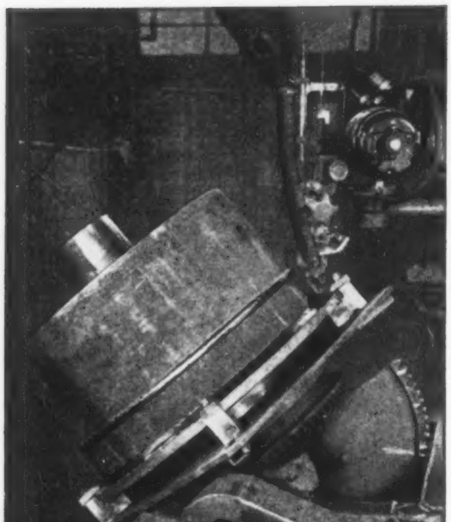

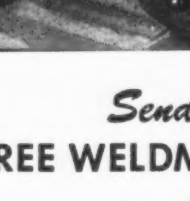

—The Road Ahead—

Continued

Only third of elements find wide use in industry . . . Magnesium from sea water suggests new possibilities.

the plywood industry, faced with a declining supply of high-grade peeler logs, is learning to use grades which not long ago were culls. As the rich iron ores of the Mesabi approach exhaustion, we are learning to use lower grade taconites. Bauxite reserves need not limit our future aluminum output, for we already know how to make aluminum from clays of which this nation has a fabulous supply.

Renewing Renewables. The United States for generations has been "mining out" its potentially renewable resources — its forests, soil, and underground water. Restoration of severely depleted resources is a slow and costly business, if possible at all. We are learning only slowly that it pays to use such resources on a "sustained yield" basis. Maintaining productivity as a regular adjunct of planting and harvesting, or restraining withdrawals to match replacement, is far less costly in the long run than the alternative, so long practiced, of getting out the best, and moving on.

Unemployable resources

Finding Work for Presently Unemployable Resources. Perhaps the greatest increases in our usable resource base could be achieved by learning to tap fruitfully certain abundant components of our total resource base which up to now we have not known how to use.

The mix of materials we use today corresponds very little to the abundance with which these materials occur in nature. Among the ninety-odd known chemical elements only a third enter strongly into modern industry. Another third enters weakly if at all; the final third is just now beginning to step out of the textbook pages as a result of such wholly new activities as those which center in atomic energy. There is much more aluminum in the earth's crust than there is iron—yet we use 60 times as much iron as aluminum. Copper is

Turn to Page 318


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BAKER'S MAGDOLITE
The J. E. Baker Company takes pride in announcing the completion of its new, modern plant in York, Pennsylvania. This new operation, supplementing our other plants in Eastern Pennsylvania and Ohio, will enable us to meet the increased demand for dolomite necessitated by the tremendous expansion of the steel industry. Yes, we can now assure you of the kind of dependable dolomite shipments that the people in the steel industry have needed—and to a larger area.
The superior quality of this new source of dolomite means the continuance of BAKER'S MAGDOLITE'S leadership within the industry . . . and guarantees top performance for you. Yes, those who know insist on BAKER'S MAGDOLITE . . . the original deadburned dolomite!
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YORK, PENNSYLVANIA

—The Road Ahead—

Continued

Versatile synthetic materials to play wider role . . . But they cannot relieve basic shortages now.

next highest to iron in use yet as a metal it ranks in seventeenth place in abundance in the earth. And the most abundant metal in the earth's crust, silicon, finds as a metal almost no use at all.

Materials research

This is not to suggest that we can conform our pattern of materials use to the table of their abundance in the earth; the fact nevertheless remains that in many respects major materials research has yet to begin. If, for example, we can solve the technical problems of producing titanium metal in quantity, and of making magnesium a more acceptable metal of industry, we will have greatly strengthened our materials position. Our twentieth century industrial successes in extracting nitrogen from the air and magnesium from seawater suggest that we should seek out further ways of exploiting the ocean and atmosphere as abundant sources of materials. The heart of this problem, like so many others, is costs. A satisfactory method of producing pure oxygen from the atmosphere has existed for a long time—but the product is still too expensive for the massive industrial use to which oxygen could be put.

Synthesizing New Materials. The most notable supplements to our materials stream in recent years have been an array of new synthetics — various highly versatile plastics, artificial fibers and pharmaceuticals, synthetic rubber, and the like. These synthetic materials

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—The Road Ahead—

Continued

Load on individual metals will vary with changes in market costs. . . . Over-designing invites waste.

may, in many cases, be superior to the article replaced, and cheaper as well. Some offer qualities unknown in older, natural materials.

Synthetics can be expected to play an expanding role in our materials stream and hopefully can relieve some of our most serious difficulties. The prospects for relief from materials shortages in the near future through the route of synthetic materials can be exaggerated, but modern science and technology, which have helped create materials shortages by expanding demand, are challenged now to help solve the materials problem in a host of ways, not least of which is by synthesizing new substances from abundant or renewable resources.

Function decides

So far, the opportunities discussed all aim at expanding the supply of materials. Similarly important opportunities exist through reducing demand and changing use. In the last analysis it is really not the individual material with which we are concerned but rather the function it performs. The essential aim is to have enough materials to perform all necessary functions at the lowest possible cost. We can shift from scarce to abundant resources; make more efficient use of materials; and recycle more as scrap.

Enlarge supply

Shifting the Load From Scarce to Abundant. As copper became scarcer in supply relative to aluminum, aluminum moved in to perform certain functions previously performed by copper. As lead became scarcer and higher priced, plastics began to supplant lead for such functions as cable covering.

These examples make it clear that our attention should be focused just as much on expanding the output and use of the abundant materials as upon enlarging the supply of scarce materials; for some purposes an extra pound of aluminum or plastics may ease the situation as

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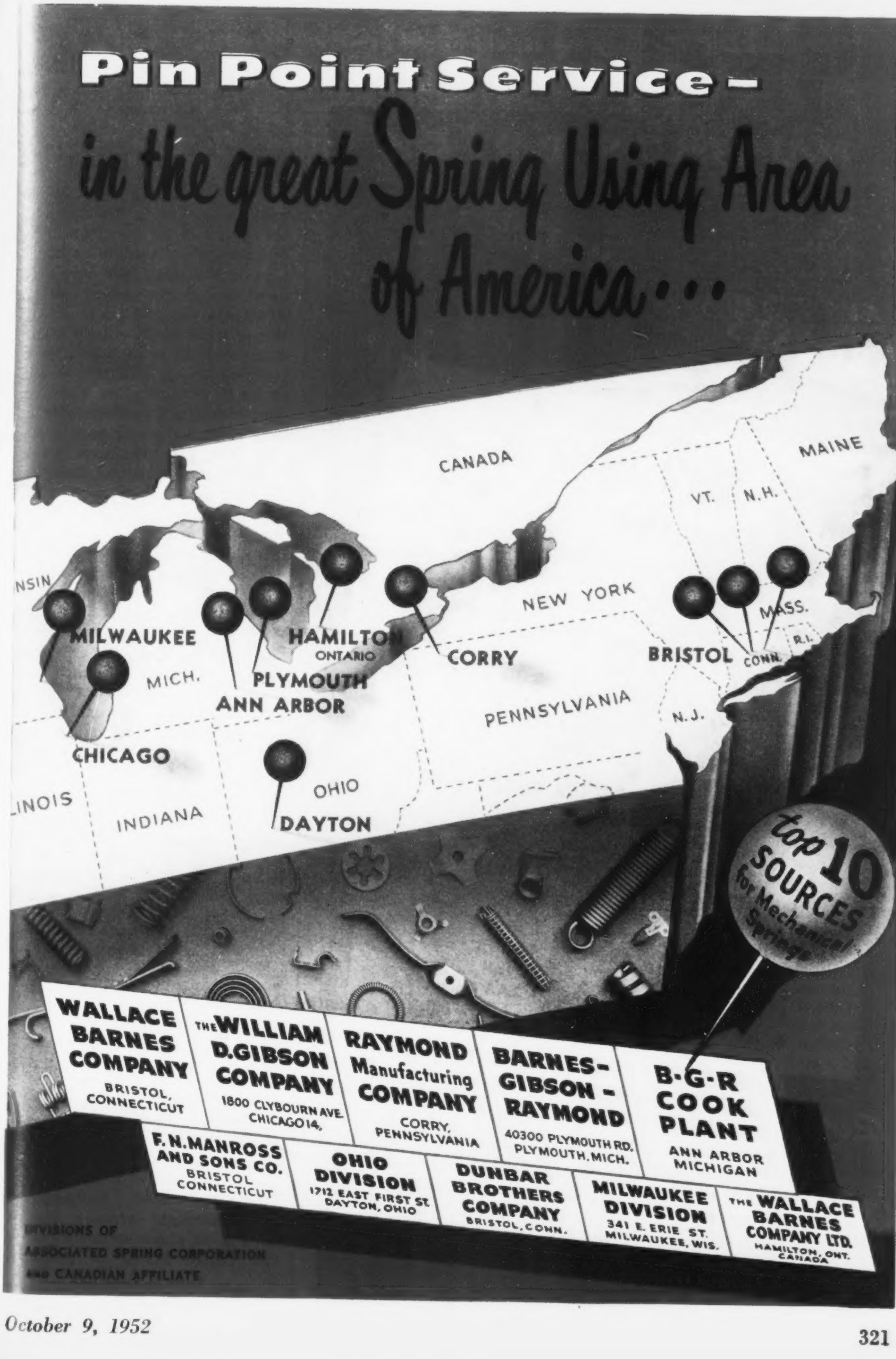

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Better care, corrosion prevention can save U. S. $5.5 billion a year . . . Need better scrap reclamation.

much as another pound of copper or lead.

Making Materials Work Harder and Longer. The United States has been lavish in its use of materials, because of their comparative abundance in the past. We have often used two pounds of a material where one would do. Vast quantities of material have been wasted both physically and economically by "over-designing" and "over-specification." Similarly we have frequently designed products with little concern for giving them a long life or getting maximum service from the materials and labor embodied in them. Such free-handedness with materials has not been a waste so long as it satisfied various tastes for which we were willing and able to pay. We drive heavier automobiles than is necessary for mere transportation, and we adorn them with chromium because we like them that way. We blow thousands of tons of lead into the atmosphere each year from the high octane gas burned in our cars because we like quick pick-up on the road and enjoy beating the other driver at the stop light.

These lavish uses of materials stem from the choices we make when we spend our time and our money. They are valid choices in a society which places a high premium on freedom of choice. But we must become more aware that many of our production and consumption habits are extremely expensive in terms of scarce materials and that often a trivial change of taste or slight reduction in personal satisfaction can bring about tremendous savings of materials. Rising cost is probably the only factor that can cause us to reduce our use of materials in these categories.

Many articles wear out for lack of sufficient care. The atmosphere takes a terrific toll of metals inadequately protected. Estimates of losses through corrosion run as high as 5.5 billion dollars a year in the United States—in protective

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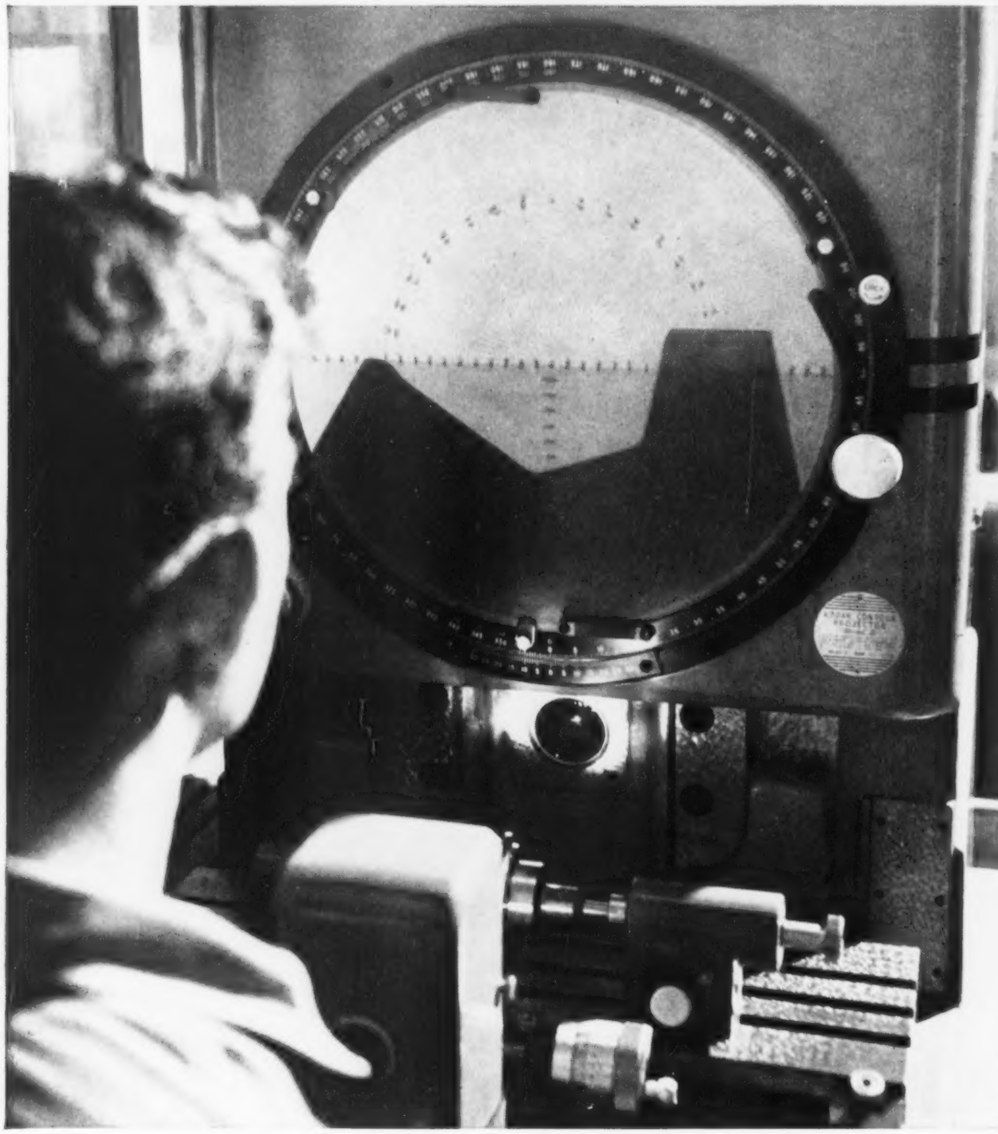

Front Row at the Raceway

TAKING STEPS to assure that the sides of bearing rings will be parallel to each other, and to the ball track, begins with proper tooling.

That's why Federal spares no pains to gage the form tools used to produce its ball bearings. Here, for example, a technician inspects contours in an optical comparator; a prism of light projects the tool outline, 20 times enlarged, onto the gridded screen. By careful inspection, he can often hold difficult tolerances to 0.0001 in. or finer.

It's by this thinking in terms of perfection, not time, that Federal produces quiet, friction-free ball bearings. Such precautions are your assurance of top performance from *every* Federal Ball Bearing. *The Federal Bearings Co., Inc., Poughkeepsie, N. Y.*

Federal

Ball Bearings

One of America's Leading Ball Bearing Manufacturers

—The Road Ahead—

Continued

Better recovery techniques can boost yields from scrap materials . . . Methods now haphazard.

coverings such as paints, lacquers, and varnishes, we probably spend another 1.2 billion dollars.

Annual loss high

Much scientific and engineering thought goes into the problem of corrosion prevention, and with much success here and there; yet the annual loss remains extremely high.

Giving Materials a Second Life. The more materials we embody in goods and structures the larger becomes our stockpile of potential scrap. Frequently the man-hour cost of reclaiming this material is so great that recovery does not pay, but better techniques and better organization for collecting, sorting, identifying, and reclaiming scrap can add large tonnages to our total supply of metals and other materials, and reduce the drain against primary resources. For so highly industrialized a nation, our facilities for the collection, recovery, and reclamation of once-used materials is haphazard in the extreme.

ASM GOLD MEDAL AWARD

Dr. Robert F. Mehl, head of the Dept. of Metallurgy, Carnegie Institute of Technology, Pittsburgh, will receive the 1952 American Society for Metals' Gold Medal for outstanding service in the field of metallurgy. The award will be presented Thursday, Oct. 23, at the annual ASM dinner, Benjamin Franklin Hotel, Philadelphia.

Established in 1943, the award recognizes outstanding metallurgical knowledge and exceptional ability in diagnosis and solution of diversified metallurgical problems. Dr. Mehl has been associated with Carniegie Institute of Technology for 20 years.

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List of Exhibitors

At National Metal Exposition, Convention Hall, Philadelphia, Oct. 20 through 24th inclusive.

Exhibitor	Booth
A.B.C. Die Casting Machine Co., Chicago	1563
Acme Mfg. Co., Detroit	1716
Acme Steel Co., Chicago	1977
Air Products, Inc., Allentown, Pa.	1662
Air Reduction Sales Co., New York	1623
Ajax Electric Co., Inc., Philadelphia	624
Ajax Electrothermic Corp., Trenton, N. J.	624
Ajax Engineering Corp., Trenton, N. J.	624
Ajusto Equipment Co., Toledo	1376
Allegheny Ludlum Steel Corp., Pittsburgh	141
Allen Mfg. Co., Hartford	1825
Allied Chemical & Dye Corp., General Chemical Div., New York	1019
Allison Co., Bridgeport, Conn.	1409
Alloy Engineering & Casting Co., Champaign, Ill.	507
Alloy Metal Wire Co., Inc., Prospect Park, Pa.	550
Alloy Rods Co., York, Pa.	448
Alpha Metals, Inc., Jersey City, N. J.	1862
Alvey-Ferguson Co., Cincinnati	530
American Brake Shoe Co., New York	130
American Brass Co., Waterbury, Conn.	241
American Chain & Cable Co., Inc., Bridgeport, Conn.	706
American Cyanamid Co., New York	344
American Cystoscope Makers, Inc., New York	242
American Gas Assn., New York. . 1601,	910
American Gas Furnace Co., Elizabeth, N. J. . . . 1701, 1601,	910

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Exhibitors
Continued

Exhibitor	Booth
American Machine & Foundry Co., New York	1124
American Machine & Metals, Inc., East Moline, Ill.	1239
American Manganese Steel Div., American Brake Shoe Co., New York	130
American Metaseal Corp., West New York, N. J.	1138
American Nickeloid Co., Peru, Ill.	1378
American Non-Gran Bronze Co., Berwyn, Pa.	1946
American Optical Co., Instrument Div., Buffalo	442
American Platinum Works, Newark, N. J.	1972
American Pullmax Co., Inc., Chicago	1449
American Silver Co., Inc., Flushing, N. Y.	709
American Society for Metals, Cleveland	1619
American Wheelabrator & Equipment Corp., Mishawaka, Ind.	1749
Ampco Metal, Inc., Milwaukee	1217
Amplex Mfg. Co., Detroit	1954
Ansco Div., General Aniline & Film Corp., Binghamton, N. Y.	929
Applied Research Laboratories, Montrose, Calif.	1757
Arcair Co., Bremerton, Wash.	1132
Arcos Corp., Philadelphia	309
Aronson Machine Co., Arcade, N. Y.	718
Arwood Precision Casting Corp., Brooklyn	1758
Atlas Press Co., Kalamazoo, Mich.	602
Atomic Energy of Canada, Ltd.	1479
Automatic Temperature Control Co., Inc., Philadelphia	1768
Automotive Industries, Philadelphia	1468
Avon Tube Div., Higbie Mfg. Co., Rochester, Mich.	1961
Babcock & Wilcox Co., New York	340
Baird Associates, Inc., Cambridge, Mass.	416
Baker & Co., Inc., Newark, N. J.	1210
Baldwin-Lima-Hamilton Corp., Eddystone, Pa.	1520
Barber-Colman Co., Rockford, Ill.	641
Bausch & Lomb Optical Co., Rochester, N. Y.	405
Bell & Gossett Co., Morton Grove, Ill.	1772
Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio	1710
Beryllium Corp., Reading, Pa.	1539
Black Drill Co., Cleveland	1350
Blackstone Mfg. Co., Inc., Chicago	1382
G. S. Blakeslee & Co., Industrial Sales, Div., Chicago	540

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Exhibitors

Continued

Exhibitor	Booth
Bowser, Inc., Fort Wayne, Ind.	1658
Brainard Steel Div., Sharon Steel Corp., Warren, Ohio	660
Bridgeport Brass Co., Bridgeport, Conn.	1035
Charles Bruning Co., Inc., Chicago	1440
Brush Development Co., Instrument Div., Cleveland	1358
Buck Tool Co., Kalamazoo, Mich.	905
Buehler, Ltd., Chicago	208
Bundy Tubing Co., Detroit	1839
Cam-Lok Div., Empire Products, Inc., Cincinnati	1116
Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport, Conn.	706
Carboloy Div., General Electric Co., Detroit	816
J. A. Carlin Co., Inc., Bala-Cynwyd, Pa.	1310
Carpenter Steel Co., Reading, Pa.	350
Castings Engineers, Inc., Chicago	805
Challenge Machinery Co., Grand Haven, Mich.	932
Chase Brass & Copper Co., Waterbury, Conn.	1220
Chem-Fin Corp., Lansdale, Pa.	1730
Chicago Metal Hose Corp., Maywood, Ill.	534
Chicago Rivet & Machine Co., Bellwood, Ill.	1819
Chicago Tool & Engineering Co., Chicago	1023
Chilton Co., Inc., Philadelphia	1468

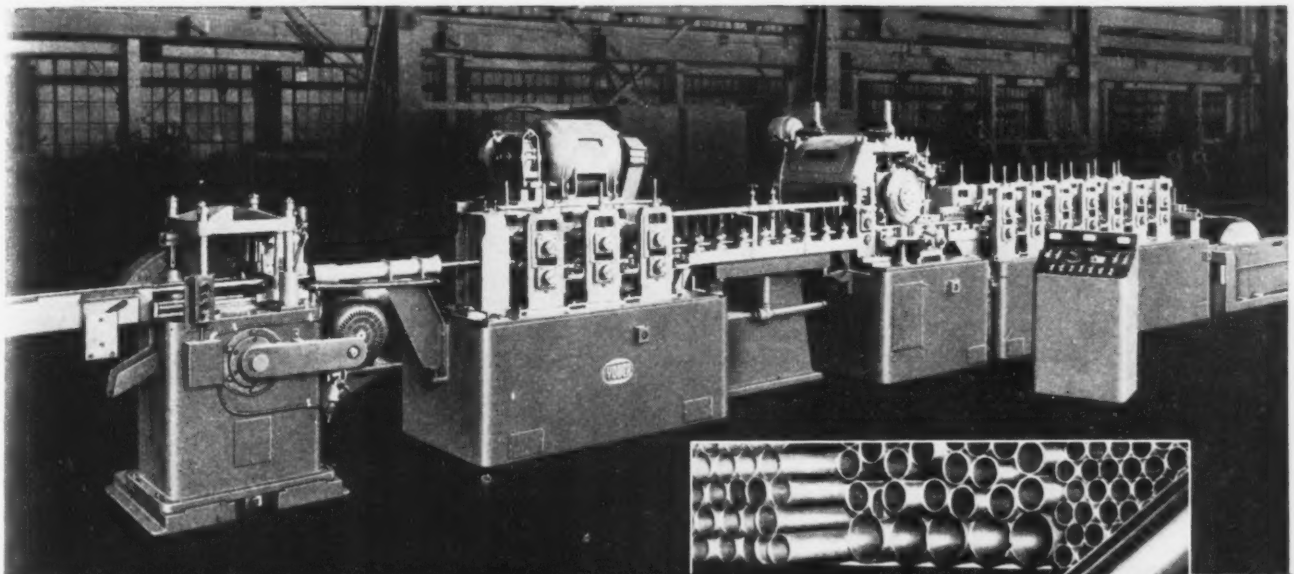
Three Win $2000

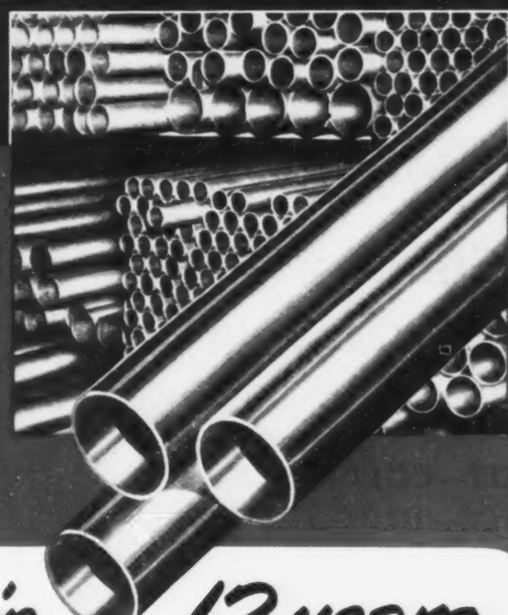
During the week of the Metal Show the American Society for Metals will award three cash prizes of $2000 each for the best metallurgical engineering teaching during 1951-1952.

The winners are: Professors Arthur A. Burr, Rensselaer Polytechnic Institute; Joseph W. Spretnak, Ohio State University, and Robert D. Stout, Lehigh University.

Exhibitor	Booth
Chrysler Corp., Detroit	1954
Cincinnati Milling Machine Co., Cincinnati	1610
Cities Service Oil Co., New York	1319
Climax Molybdenum Co., New York	515
Clinton Machine Co., Warner Div., Detroit	610

(Turn to Page 334)





Electric Weld Pipe and Tube Mills

1300% Increase in 12 years

In the brief period of twelve years, from 1938 to 1950, the manufacture of electric welded pipe and tubing in the U. S. A. grew nearly 1300%, becoming one of the child prodigies of the American metal working industries.

The beginning of this development was sparked by the introduction of the revolutionary new Yoder electric resistance welder, and followed by many other Yoder improvements in cold process pipe and tube making equipment. The latest of these is the highly efficient Yoder 4-in-1 cross type transformer.

Year by year, Yoder has built, installed and serviced more electric-weld tube mills than all other builders combined. The experience so gained has been invaluable in bringing Yoder mills to their present state of pre-eminence.

Most significant is the fact that the demand for electric welded pipe and tubes has expanded faster than the supply.

If you have been thinking of making any grade or grades of pipe and tubing, from steel or non-ferrous metals, in sizes from 1/4" up to 30 or 40-inch diameter, Yoder literature, information and recommendations are yours for the asking.

THE YODER COMPANY • **5510 Walworth Avenue, Cleveland 2, Ohio**

Complete Production Lines

- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

Exhibitors

Continued

Exhibitor	Booth
Coles Cranes, Inc., Joliet, Ill.	1369
Collins Micro-Flat Co., Los Angeles	1281
Commander Mfg. Co., Chicago	531
Commercial Shearing & Stamping Co., Youngstown	1616
Continental Industrial Engineers, Inc., Chicago	1601, 1910
Continental Tooling Service, Inc., Dayton	1027
Cooper Metallurgical Laboratories, Cleveland	923
Crane Packing Co., Chicago	811
Crucible Steel Co. of America, New York	104
Curtis Machine Div., Lincoln Park Industries, Inc., Jamestown, N. Y.	937
Dake Engine Co., Grand Haven, Mich.	1761
Deepfreeze Distributing Corp., Sub Zero Products Mfg. Div., Cincinnati	1320
Delaware Tool Steel Corp., Wilmington, Del.	1275
Delta Power Tool Div., Rockwell Mfg. Co., Milwaukee	1650
A. P. De Sanno & Son, Machinery Div., Phoenixville, Pa.	1252
Detrex Corp., Detroit	1849
DeWalt, Inc., Lancaster, Pa.	1120
Diamond Iron Works, Inc., Minneapolis	1557

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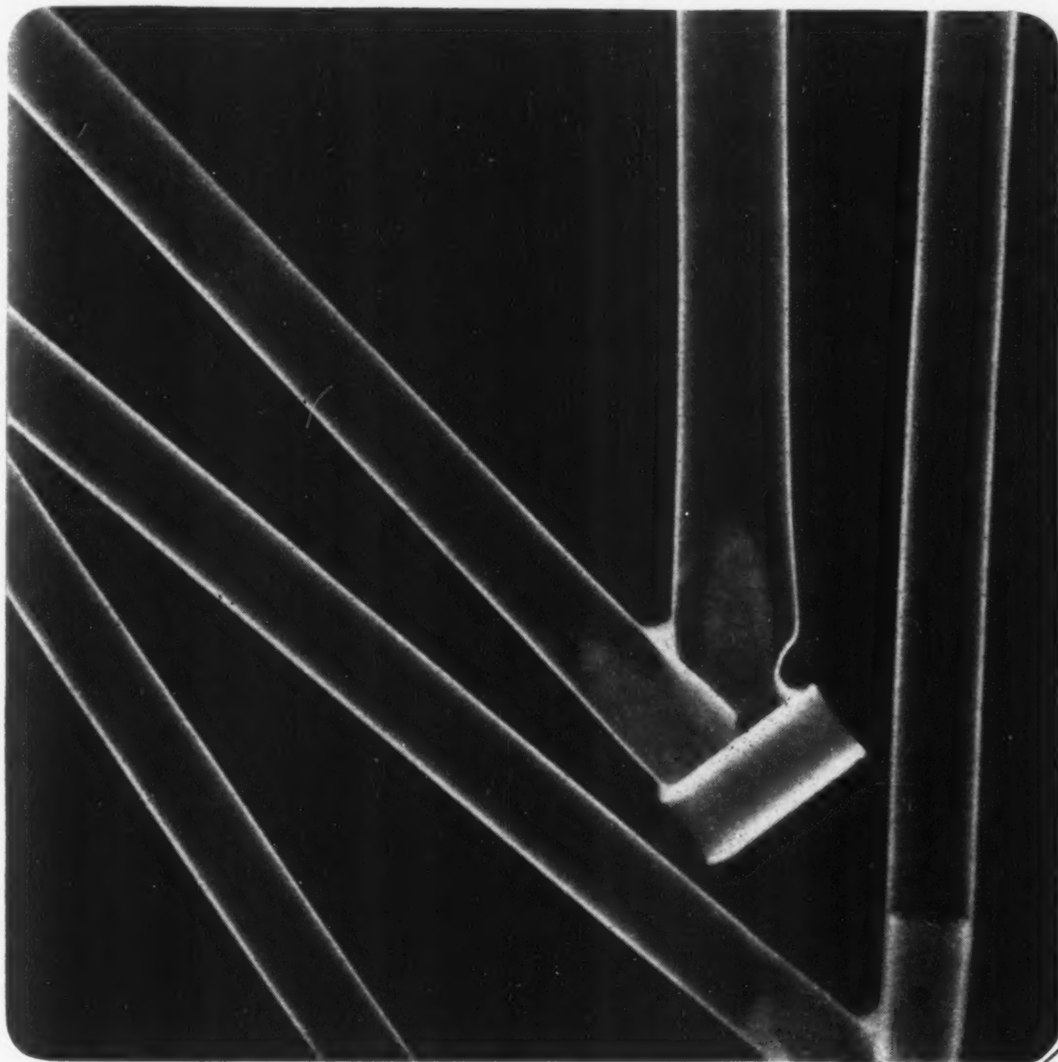
"I always make this my last stop."

Radiography checks—



then double checks

LANDING GEAR STRUTS lead a life of punishment. Though light, they must be strong. Their joints must be sound. Radiography is the method used to prove them sound.

A maker of amphibian aircraft goes even further. Though treated and sealed, strut members can develop internal corrosion and become weakened. Radiography alone can provide the required nondestructive examination of these internal surfaces. So it has become routine to x-ray these struts as part of the periodic inspection of the planes.

This is but one example of how radiography is proving a boon to the welding process. It is helping to open new fields for the use of welding—especially in the fabrication of highly stressed products and assemblies.

Look into the ways Radiography can aid your business. Your x-ray dealer will be glad to give you full information and assistance.

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography—

another important function of photography

Kodak
TRADE-MARK

Exhibitors

Continued

Exhibitor	Booth
Distillation Products Industries, Rochester, N. Y.	1428
Diversey Corp., Chicago	646
Diversified Metal Products Co., Los Angeles	1767
DoAll Co., Des Plaines, Ill.	524
Dow Chemical Co., Midland, Mich.	730
Dow Furnace Co., Detroit	1315
Drever Co., Philadelphia	1980
Wilbur B. Driver Co., Newark, N. J.	521
Driver-Harris Co., Harrison, N. J.	1919
East Shore Machine Co., Cleveland	1455
Eaton Mfg. Co., Reliance Div., Massillon, Ohio	912

"Don't look now, but he's slept here all week."

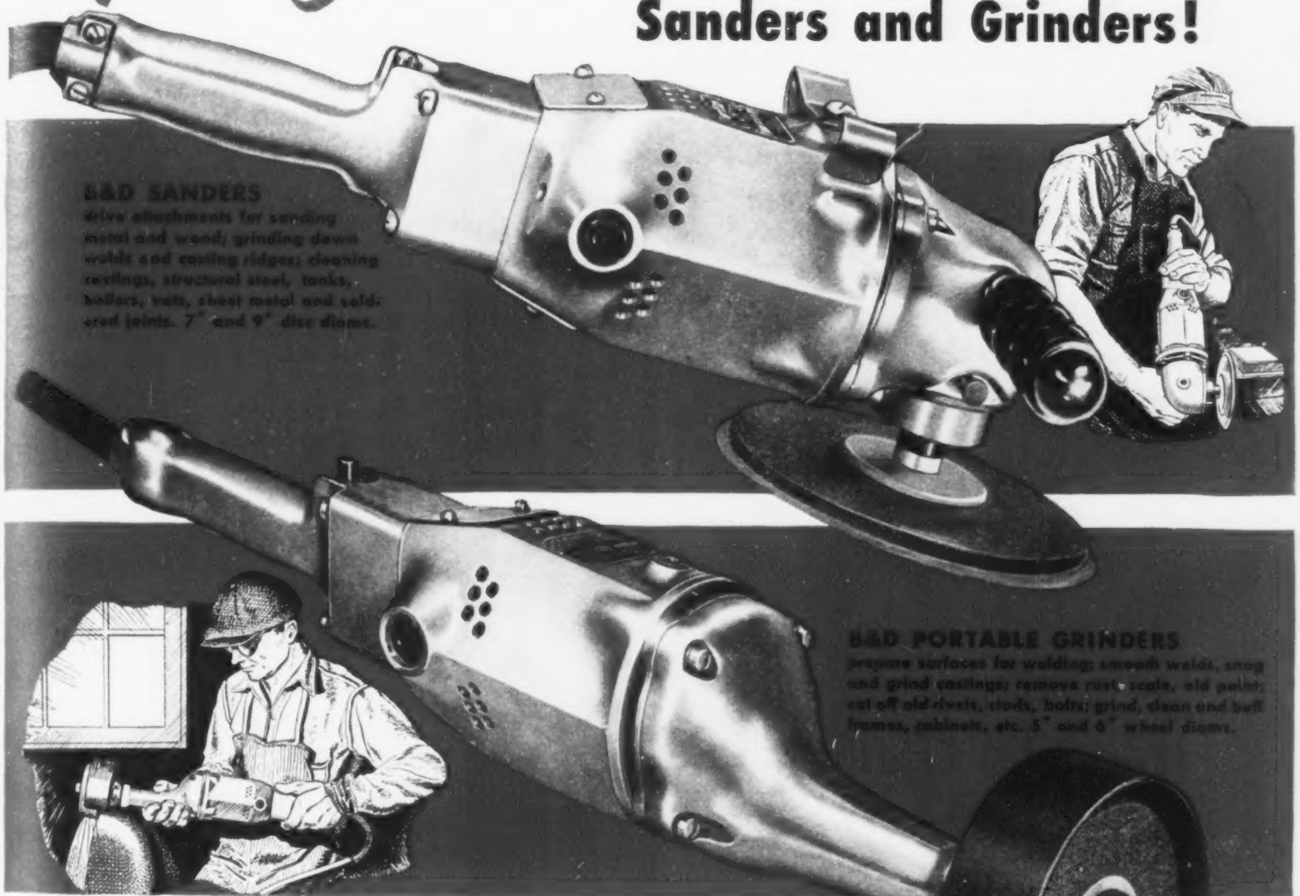
Exhibitor	Booth
Eclipse Fuel Engineering Co., Rockford, Ill.	1926, 1601, 1910
Ekstrand & Tholand, Inc., New York	1567
Elastic Stop Nut Corp. of America, Union, N. J.	640
Eldorado Mining & Refining, Ltd., Commercial Prods. Div., Ottawa, Ont.	1479
Electric Furnace Co., Salem, Ohio	341
Electro-Alloys Div., American Brake Shoe Co., Elyria, Ohio	130
Electro Arc Mfg. Co., Ann Arbor, Mich.	1778
Elox Corp. of Michigan, Clawson, Mich.	1355
Empire Products, Inc., Cincinnati	1116
Engineered Castings Div., American Brake Shoe Co., Rochester, N. Y.	110
Enthone, Inc., New Haven, Conn.	1857
Ercona Corp., Scientific Instrument Div., New York	920
Erico Products, Inc., Cleveland	1432
Iver J. Esbenson Co., Denver	916

Turn to Page 338

Work heavy, bulky, hard to move?

Bring the tool to the work...

with Black & Decker Sanders and Grinders!



They're <u>powerful</u> and <u>portable</u>!

NO MATTER how big or bulky your abrasive jobs, you'll cut costs and speed up work when you switch from hand methods to Black & Decker power! B&D Sanders drive abrasive discs, saucer grinding wheels, "Whirlwind" wire cup brushes, gouging and planing heads. B&D Portable Grinders drive grinding wheels, "Whirlwind" wire wheel brushes, cotton buffing wheels. And *both* give you: (1) Dependable, full-powered motors tailor-made by Black & Decker for the tools they drive; (2) Perfect balance for easy handling, less operator fatigue; (3) Tough, longer-lasting parts for extra years of service, lower tooling costs!

See your nearby B&D Distributor for demonstrations, expert help on any tooling problem.

Write for free catalog of over 100 Electric Tools to: THE BLACK & DECKER MFG. Co., 603 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D **Black & Decker**

PORTABLE ELECTRIC **TOOLS**

WORLD'S LARGEST, MOST COMPLETE LINE

Exhibitors

Continued

Exhibitor — Booth

- Eutectic Welding Alloys Corp., Flushing, N. Y. 1001
- Fahralloy Co., Harvey, Ill. 1969
- Fawick Airflex Co., Inc., Cleveland 1960
- R. Y. Ferner Co., Inc., Boston 1123
- Firth Sterling Inc., Pittsburgh 421
- Flexonics Corp., Maywood, Ill. 534
- Fostoria Pressed Steel Corp., Fostoria, Ohio 1571
- Gas Appliance Service, Inc., Chicago 1920, 1601, 1910
- Gebr Heller Maschinenfabrik, Nurtingen, Germany 1620
- Gehnrich & Gehnrich, Inc., Woodside, N. Y. 1916, 1601, 1910
- General Alloys Co., Boston 204
- General Aniline & Film Corp., New York 929
- General Electric Co., Apparatus Sales Div., Schenectady, N. Y. 251
- General Electric Co., X-Ray Dept., Milwaukee 1549
- General Motors Corp., Rochester, New York 1031
- Globe Stamping Div., Hupp Corp., Cleveland 1354
- B. F. Goodrich Co., Automotive & Aviation Div., Akron, Ohio 617
- Graham Corp., Ferndale, Mich. 933
- Gray, Inc., Minneapolis 924
- Gray Iron Founders' Society, Inc., Cleveland 1340
- Gregory Industries, Inc., Lorain, Ohio 1850
- Griffith-Raguse & Co., Inc., Philadelphia 1310
- Gulf Oil Corp., Pittsburgh 1515
- H & H Tube & Mfg. Co., Detroit 1487
- H P L Mfg. Co., Cleveland 1951
- William J. Hacker & Co., Inc., New York 1279
- Hammond Machinery Builders, Inc., Kalamazoo, Mich. 1130
- Handy & Herman, New York 110
- Harnischfeger Corp., Milwaukee 1525
- Harper Electric Furnace Corp., Buffalo 1857
- Harshaw Chemical Co., Cleveland 1420
- C. I. Hayes, Inc., Providence 1262
- Haynes Stellite Div., Union Carbide & Carbon Corp., Kokomo, Ind. 1202
- Heath Engineering Co., Fort Collins, Colo. 916
- Heintz Mfg. Co., Philadelphia 1668
- Heli-Coil Corp., Danbury, Conn. 1953
- Heller Machine Co., New York 1620
- Heppenstall Co., Pittsburgh 1512

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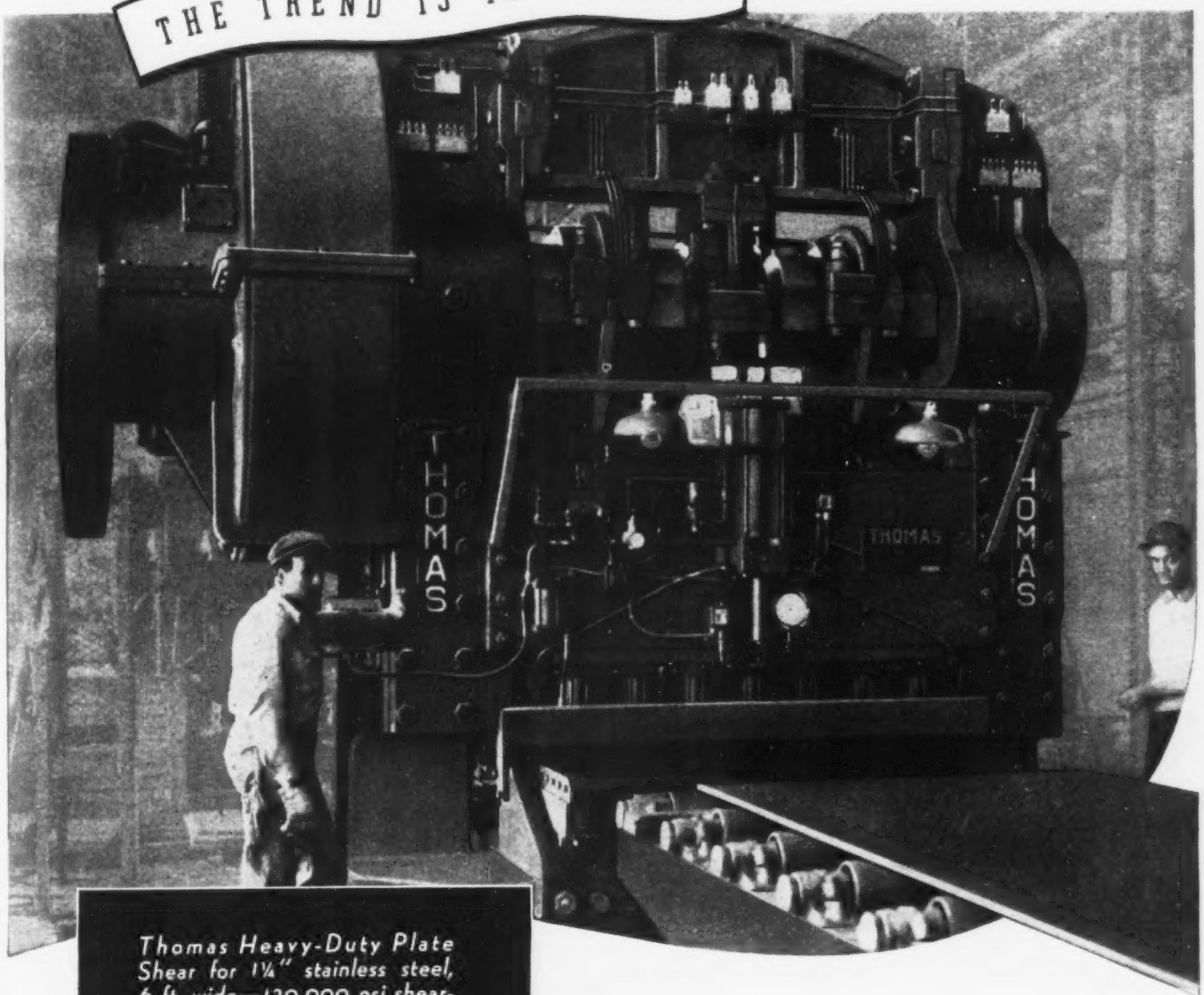
THOMAS *specializes in building* HEAVY SHEARS

THE TREND IS TO THOMAS



Thomas Heavy-Duty Plate Shear for 1¼" stainless steel, 6 ft. wide—120,000 psi shearing strength. Installed in the mills of the Eastern Stainless Steel Co., Baltimore, Md.

This is another example of Thomas' ability in designing and building machines to meet specialized shearing requirements for heavy mill service!

THOMAS

MACHINE MANUFACTURING CO.

PITTSBURGH 23, PA.

PUNCHES · SHEARS · PRESSES · BENDERS · SPACING TABLES

32

Exhibitors

Continued

Exhibitor	Booth
Higbie Mfg. Co., Rochester, Mich.	1961
Hitchiner Mfg. Co., Inc., Milford, N. H.	817
Charles A. Hones, Inc., Baldwin, N. Y.	1912, 1601, 1910
E. F. Houghton & Co., Philadelphia	724
Howard Foundry Co., Chicago, Ill.	501
Hupp Corp., Cleveland	1354
Illinois Testing Laboratories, Inc., Chicago	1457
Induction Heating Corp., Brooklyn	1870
Industrial Heating Equipment Co., Detroit	1439
Industrial Tectonics, Inc., Ann Arbor Mich.	919
Institute of Industrial Launderers, Cleveland	1362
International Nickel Co., Inc., New York	230, 324
Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio	1256
Ipsen Industries, Inc., Rockford, Ill.	131
Iron Age, New York	1842
Janney Cylinder Co., Philadephia	1327
Jarrell-Ash Co., Boston	1205
Jensen Specialties, Inc., Detroit	1415
S. C. Johnson & Son, Inc., Racine, Wis.	1119
C. Walker Jones Co., Philadelphia	1257
K S M Products, Inc., Merchantville, N. J.	834
Kanthal Corp., Stamford, Conn.	1266
Kearney & Trecker Corp., Plainfield, N. J.	1941
Kelite Products, Inc., Los Angeles	1260
Kelley-Koett X-Ray Corp., Covington, Ky.	1809
C. M. Kemp Mfg. Co., Baltimore, Md.	1801, 1601, 1910
Kennametal, Inc., Latrobe, Pa.	1319
L. R. Kerns Co., Chicago	651
Keystone Drawn Steel Co., Spring City, Pa.	1965
Mrs. Andrew King, Ardmore, Pa.	121
Knapp Mills, Inc., Specialties Div., Wilmington, Del.	808
Kold-Hold Mfg. Co., Lansing, Mich.	1462
Latrobe Steel Co., Latrobe, Pa.	1649
Leeds & Northrup Co., Philadelphia	304
E. Leitz, Inc., New York	1343
Lepel High Frequency Labs, Inc., Woodside, N. Y.	1114
Lincoln Electric Co., Cleveland	140
Lincoln Park Industries, Inc., Jamestown, N. Y.	937
Lindberg Engineering Co., Chicago	330

Turn to Page 344

When all eyes can read the size

Assembly moves faster

good judgment calls for

PARKER-KALON®

when good design calls for

SOCKET SCREWS

Your INDUSTRIAL SUPPLY DISTRIBUTOR— *your local source for P-K Socket Screws— works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

Some sharp-eyed mechanics are expert at estimating the size of a plain head cap screw. But *most* assembly workers, and especially learners, need the screw that puts size beyond question . . . *the P-K Size-Mark Socket Head Cap Screw.*

The size is clearly incised on the head, can be seen at a glance. Saves time and wasted screws when sizes get mixed up, prevents errors and spoiled work. It's a good sales feature, too, because installation and repair work on your product is simpler and easier.

Only P-K offers both Size-Mark and Gear Grip in Socket Head Cap Screws. Ask for samples. See how they save time and trouble all along the line. Parker-Kalon Corporation, 200 Varick Street, New York 14.

SIZE-MARKED CAP SCREWS • GROUND THREAD SET SCREWS • FLAT HEAD CAP SCREWS • STRIPPER BOLTS • PIPE PLUGS • HEX KEY

CHEMICAL USERS' GUIDE To General Chemical Products for the Metal Industries

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTHS	SHIPPING CONTAINERS	APPLICATIONS
Sulfuric Acid H_2SO_4	Liquid	66° Be (93.19%) 99% Oleum, 20-65%	Carboys (except Oleum) Steel Drums Tank Trucks Tank Transports Tank Cars	Pickling and descaling; electroplating; bright dipping; electrolytic polishing; galvanizing; anodizing.
Hydrochloric Acid HCl + water *(Muriatic Acid)*	Liquid	18° Be (27.92%) 20° Be (31.45%) • 22° Be (35.21%)	Carboys Tank Trucks Tank Cars	Pickling; electroplating; bright dipping; galvanizing; tinning; etching metals; dissolving metals.
Nitric Acid HNO_3 + water	Liquid	36° Be (52.30%) 38° Be (56.52%) 40° Be (61.38%) 42° Be (67.18%) 95%	Carboys (except 95%) Drums Tank Cars	Pickling; electroplating; bright dipping; oxide finishing; dissolving and stripping metals.
Hydrofluoric Acid HF + water	Liquid	60% 70%	Steel Drums & Tank Cars	Pickling; electroplating; electrolytic polishing; bright dipping.
Sodium Fluoride NaF	White Powder	95% or 97% Light or Dense	Multiwall Paper Bags Fibre Drums	Manufacture of rimmed steel; heat treating; galvanizing; pickling; electroplating.
Sodium Bifluoride $NaHF_2$	White Powder	95% or 97% $NaF \cdot HF$	Fibre Drums	Electroplating.
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	P_2O_5—18.4%	Multiwall Paper Bags Fibre Drums	Alkali cleaning.
Sodium Metasilicate $Na_2SiO_3 \cdot 5H_2O$	White Granules	98.5%	Multiwall Paper Bags Fibre Drums	Alkali cleaning.
Oxalic Acid $C_2H_2O_4 \cdot 2H_2O$	Colorless Crystals	99.5%	Multiwall Paper Bags Fibre Drums	Oxide finishing; metal cleaning.
Potassium Fluoborate KBF_4	White Powder	97.0%	Fibre Drums	Aluminum and magnesium casting; as a flux and grain refiner for aluminum; for removing magnesium from secondary aluminum alloys.
Sodium Fluoborate $NaBF_4$	White Powder	94.0%	Fibre Drums	
Ammonium Fluoborate NH_4BF_4	White Powder	96.0%	Fibre Drums	Aluminum and magnesium casting; electroplating.
Fluoboric Acid HBF_4 + water	Liquid	42.0%	Rubber Drums	Electroplating; metal cleaning or dipping; electropolishing.
Lead Fluoborate $Pb(BF_4)_2$ + water	Liquid	51.0%	Carboys	Electroplating.
Tin Fluoborate $Sn(BF_4)_2$ + water	Liquid	47.0%	Carboys	Electroplating.
Copper Fluoborate $Cu(BF_4)_2$ + water	Liquid	45.0%	Carboys	Electroplating.
Iron Fluoborate $Fe(BF_4)_2$ + water	Liquid	45.0%	Carboys	Electroplating.
Nickel Fluoborate $Ni(BF_4)_2$ + water	Liquid	42%	Carboys	Electroplating.

The products advertised are commercial chemicals having various uses, some of which may be covered by patents, and the user must accept full responsibility for compliance therewith.

BASIC CHEMICALS FOR AMERICAN INDUSTRY

OTHER PRODUCTS: Acetic Acid; Ammonium Thiosulfate Solution; Aqua Ammonia; Barium Fluoride; Chromium Fluoride; Copper Fluoride; Copper Sulfate; Glauber's Salt; Iron Sulfide; Nickel Fluoride; Perchloric Acid; Sodium Bisulfite, Anhydrous; Sodium Silicate; Sodium Sulfite, Anhydrous; Stannous Chloride; Tetrasodium Pyrophosphate; Phosphoric Acid; Sodium Tripolyphosphate.

GENERAL CHEMICAL DIVISION

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Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte Chicago • Cleveland • Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Providence • St. Louis San Francisco • Seattle • Yakima (Wash.)

In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

Exhibitors

Continued

Exhibitor	Booth
Linde Air Products Co., New York	1202
Lynchburg Foundry Co., Lynchburg, Va.	1927
Magna Engineering Corp., Menlo Park, Calif.	751
Magnaflux Corp., Chicago	537
Magnetic Analysis Corp., Long Island City, N. Y.	518
Mahr Mfg. Co., Div., Diamond Iron Works, Inc., Minneapolis	1557
D. E. Makepeace Co., Attleboro, Mass.	560
Malayan Tin Bureau	858
Mall Tool Co., Chicago	1276
P. R. Mallory & Co., Inc., Indianapolis	1950
Manco Mfg. Co., Bradley, Ill.	1480
Marlie Trading, Inc., New York	1280
Martindale Electric Co., Cleveland	1762
Master Builders Co., Cleveland	1777
Mechanical Handling Systems, Inc., Detroit	1472
Metal Products Sales Co., West Hartford, Conn.	817
Metal & Thermit Corp., New York	430
Metals & Controls Corp., Attleboro, Mass.	1816
Metalweld, Inc., Philadelphia	1272
Metlab Co., Philadelphia	1007
Michiana Products Corp., Michigan City, Ind.	1240
Micrometrical Mfg. Co., Ann Arbor, Mich.	1458
Mid-West Abrasive Co., Owosso, Mich.	1024
Miller Electric Mfg. Co., Appleton, Wis.	631
A. Milne & Co., New York	506
Milton Equipment Co., Philadelphia	1562
Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Philadelphia	211
Morrison Industries, Inc., Cleveland	1804, 1601, 1910
Morton Gregory Corp., Lorain, Ohio	1850
National Bearing Div., American Brake Shoe Div., St. Louis	130
National Carbon Div., Union Carbide & Carbon Corp., New York	120
National Cored Forgings Co., Inc., South Norwalk, Conn.	15
National Cylinder Gas Co., Chicago	198
National Diamond Laboratory, New York	147
National Lead Co., New York	41
National Precision Castings Co., Clifton Heights, Pa.	17

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Exhibitors

Continued

Exhibitor	Booth
National Research Corp., Cambridge, Mass.	1211
National Spectrographic Laboratories, Inc., Cleveland	1471
National Torch Tip Co., Pittsburgh	1372
National Welding Supply Assn., Philadelphia	1380
Nelco Tool Co., Inc., Manchester, Conn.	1134
Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio	1850
Newark Wire Cloth Co., Newark, N. J.	1853
New Hermes Engraving Machine Corp., New York	1478
Nicholas Equipment Co., Bellevue, Ohio	911
North American Philips Co., Inc., Mt. Vernon, N. Y.	1861
Oakite Products, Inc., New York	1715
Ohio Crankshaft Co., Cleveland	1377
Ohio Seamless Tube Co., Shelby, Ohio	1820
Ohio Steel Foundry Co., Lima, Ohio	1958
Tinius Olsen Testing Machine Co., Willow Grave, Pa.	1419
O'Neil-Irwin Mfg. Co., Lake City, Minn.	630
Opplem Co., Inc., New York	115
Osborn Mfg. Co., Cleveland	729
Pangborn Corp., Hagerstown, Md.	901
Park Chemical Co., Industrial Div., Detroit	312
Parker Machine Co., Inc., Brooklyn	1732
Parker Rust Proof Co., Detroit	1909
Partlow Corp., New Hartford, N. Y.	1577
Peters-Dalton, Inc., Detroit	1410
Philadelphia Bronze & Brass Co., Philadelphia	1587
Phliadelphia Electric Co., Philadelphia	1483
Phillips Mfg. Co., Inc., Chicago	635
Physicists Research Co., Ann Arbor, Mich.	1458
Picker X-Ray Corp., White Plains, N. Y.	441
Pittsburgh Tube Co., Pittsburgh	240
Polyplastex International, Inc., New York	927
Porter-McLeod Machine Tool Co., Inc., Hatfield, Mass.	1271
Porter Precision Products Co., Cincinnati	1025
Precision Metalsmiths, Inc., Cleveland	1461
Precision Products Co., Branford, Conn.	1125
Precision Shaves, Inc., Suffern, N. Y.	1015

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Exhibitors

Continued

Exhibitor	Booth
Precision Welder & Flexapress Corp., Cincinnati	842
Production Machine Co., Greenfield, Mass.	1540
Progressive Welder Sales Co., Detroit	928, 1105
Pyrometer Instrument Co., Inc., Bergenfield, N. J.	1729
Ransburg Electro-Coating Corp., Indianapolis	1983
Raytheon Mfg. Co., Waltham, Mass.	1815
Reeves Pulley Co., Columbus, Ind.	1553
J. W. Rex Co., Lansdale, Pa.	1750
Reynolds Metals Co., Louisville, Ky.	1550
J. A. Richards Co., Kalamazoo, Mich.	1277
Riehle Testing Machines Div., American Machine & Metals, Inc., East Moline, Ill.	1239
Rochester Products Div., General Motors, Corp., Rochester, N. Y.	1031
Rockwell Mfg. Co., Pittsburgh	1650
Rodgers Hydraulic, Inc., Minneapolis	1558
Rolle Mfg. Co., Inc., Lansdale, Pa.	750
Rolock, Inc., Fairfield, Conn.	1810
Joseph T. Ryerson & Son, Inc., Chicago	318
"S" Corrugated Quenched Gap Co., Garfield, N. J.	1119
S & S Machinery Co., Brooklyn	1657
Sales Service Machine Tool Co., St. Paul	1467
Sandvik Steel, Inc., New York	402
George Scherr Co., Inc., New York	1269
Schnell Tool & Die Corp., Salem, Ohio	1453
A. Schrader's Son Div., Scovill Mfg. Co., Inc., Brooklyn	1856
Sciaky Bros., Inc., Chicago	1719

Turn to Page 350

"That's his fifth trip today."

Booth

842

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1856
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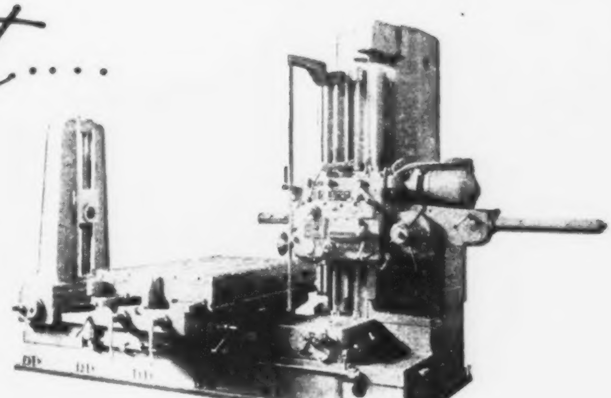
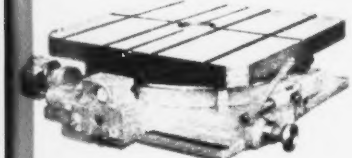
however you figure it....

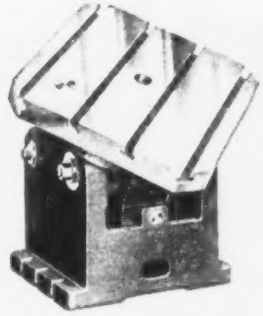
Gilberts pay off!



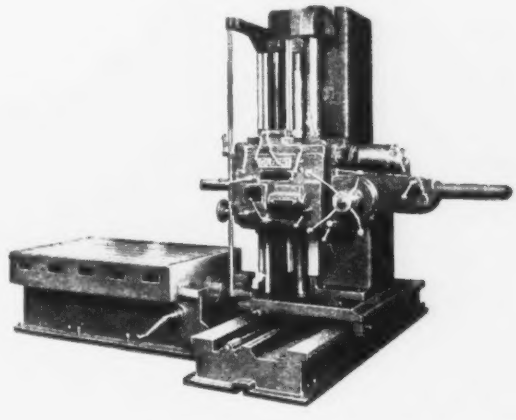
Whatever your yardsticks—sustained accuracy, operator convenience, long life, work per hour, or earning power per square foot of floor space—you'll find Cincinnati Gilbert's advanced construction features provide long range paying investments. On your next purchase of radials or horizontal boring mills check with your nearby Cincinnati Gilbert representative.

Horizontal Boring Mill: Compound rectangular table type. Head travel: 36″ to 72″. Bed: 84″ to 120″. Spindle diameter: 3½″ or 3¾″. Write for Bulletin 1040-R. Compound built-in rotary table types also furnished in comparable sizes: Bulletin 348.

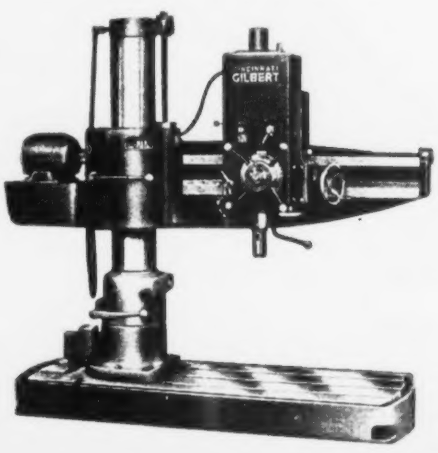




Rotary Table: (*left*) Worm driven with power rapid revolving. Hand adjustment made with dial on worm shaft reading in minutes. Dial type indexing, 36″ and 50″ square or round.
Universal Table: (*right*) Five sides of a cube can be machined at one setting of work piece. Sizes: 22″ x 22″ and 27″ x 27″ top.



Horizontal Boring Mill: Floor type. Head travel: 36″ to 96″. Column traverse: 36″ to 168″: Spindle diameters: 3½″ or 3¾″. Can be equipped with floor plates; boring bar supports; stationary, sliding, or built-in rotary tables; revolving columns, and special arrangements. Write for Bulletin 1244.



Radial Drilling Machine: 9″ and 11″ columns. Centralized, "comfort level" controls. 12 speeds, 6 feeds. Twelve basic features make these the most modern radials you can buy. Write for Bulletin 349.

THE CINCINNATI

GILBERT

MACHINE TOOL COMPANY

3366 BEEKMAN STREET • CINCINNATI 23, OHIO

—Exhibitors—

Continued

Exhibitor	Booth
Scientific Electric Div., "S" Corrugated Quenched Cap Co., Garfield, N. J.	1227
C. U. Scott & Son, Inc., Rock Island, Ill.	1228
Scovill Mfg. Co., Waterbury, Conn.	1685
Selas Corp. of America, Philadelphia	1601, 1910
Sentry Co., Foxboro, Mass	1324
Sharon Steel Corp., Sharon, Pa.	660
Sheldon Machine Co., Inc., Chicago	841
Shell Oil Co., New York	1349
A. O. Smith Corp., Milwaukee	354
Smith Welding Equipment Corp., Minneapolis	1828
Snap-On Tools Corp., Kenosha, Wis.	1127
Socony-Vacuum Oil Co., New York	1876
Solventol Chemical Products, Inc., Detroit	512
South Chester Corp., Lester, Pa.	1026
Sparkler Mfg. Co., Mundelein, Ill.	1875
Special Libraries Assn., New York	1020
Spencer Turbine Co., Hartford	1601, 1910
Sperry Products, Inc., Danbury, Conn.	1754
Standard Alloy Co., Cleveland	1250
Standard Die Set Manufacturers, Inc., Providence	1640
Standard Electrical Tool Co., Cincinnati	908
L. S. Starrett Co., Athol, Mass.	1843
Steel City Testing Machines, Inc., Detroit	1416
Steel Founder's Society of America, Cleveland	101
Steel-Parts Mfg. Co., Div. of Blackstone Mfg. Co., Inc., Chicago	1382
Steels Engineering Products, Canada, Ltd., Toronto	1369
Sterling Electric Motors, Inc., Los Ageles	1949
Frederic B. Stevens, Inc., Plating Equipment & Supply Div., Detroit	244
Edwin B. Stimpson Co., Inc., Brooklyn	605
F. J. Stokes Machine Co., Philadelphia	1385
Stone Machinery Co., Inc., Manlius, N. Y.	551
D. A. Stuart Oil Co., Chicago	1251
Sub Zero Products Mfg. Div., Deepfreeze Distributing Corp., Cincinnati	1320
Sun Oil Co., Philadelphia	1427
Superdraulic Corp., Detroit	1817
Super-Grip Anchor Bolt Co., Inc., Philadelphia	1441
Superior Tube Co., Norristown, Pa.	1610
Surface Combustion Corp., Toledo	211

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Exhibitors

Continued

Exhibitor	Booth
Sutton Engineering Co., Bellefonte, Pa.	740
Swan-Finch Oil Corp., New York	1032
Taco Heaters, Inc., Providence	1829
Tempil Corp., New York	155
Texas Co., New York	717
Thread-All Sales Co., Detroit	918
Tide Water Associated Oil Co., New York	1450
Tin Research Institute, Inc., Columbus, Ohio	852
Tincher Products Co., Sycamore, Ill.	1975
Tinnerman Products, Inc., Cleveland	1330
Titanium Alloy Mfg. Div., National Lead Co., New York	1316
Titanium Metals Corp. of America, New York	120
Tocco Div., Ohio Crankshaft Co., Cleveland	1377
Topper Equipment Co., Matawan, N. J.	1351
Torit Mfg. Co., St. Paul	1881

"That's a heck of a way to go after business, I'd say!"

Exhibitor	Booth
Turco Products, Inc., Los Angeles	102
Tyler Mfg. Co.	128
Uddeholm Co., New York	91
Udylite Corp., Detroit	21
Union Carbide & Carbon Corp., New York	120
Union Steel Products Co., Materials Handling Div., Albion, Mich.	121

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Exhibitors

Continued

Exhibitor	Booth
U. S. Electrical Motors, Inc., Los Angeles	760
U. S. Pipe & Foundry Co., Special Products Div., Burlington, N. J.	702
U. S. Plywood Corp., New York	1282
Upton Electric Furnace Co., Detroit	1519
Vanadium Corp. of America, New York	618
Vapofier Corp., Chicago	1953
Versa-Mil Co., New York	741
Viking Sales, Inc.	928
Waldes Kohinoor, Inc., Long Island City, N. Y.	1915
Walker-Turner Div., Kearney & Trecker Corp., Plainfield, N. J.	1941
Wall Colmonoy Corp., Detroit	1131
Warner Div., Clinton Machine Co., Detroit	610
Waukee Engineering Co., Milwaukee	1223
Webber Appliance Co., Inc., Indinapolis	1368
Welders Supply & Mfg. Co., Cincinnati	1380
Weldwire Co., Inc., Philadelphia	1383
Wells Mfg. Co., Three Rivers, Mich.	1678
Westinghouse Electric Corp., Pittsburgh	1510
Weston Electrical Instrument Corp., Newark, N. J.	1011
Wheelco Instruments Co., Chicago	641
Whitehead Metal Products Co., Inc. New York	1283
Edwin L. Wiegand Co., Pittsburgh	1244
Williams, Brown & Earle, Inc., Philadelhpia	1232
Wilson Mechanical Instrument Div., American Chain & Cable Co., Inc., Bridgeport, Conn.	706
Worthington Corp., Harrison, N. J.	1720
Carl Ziess, Inc. New York	920

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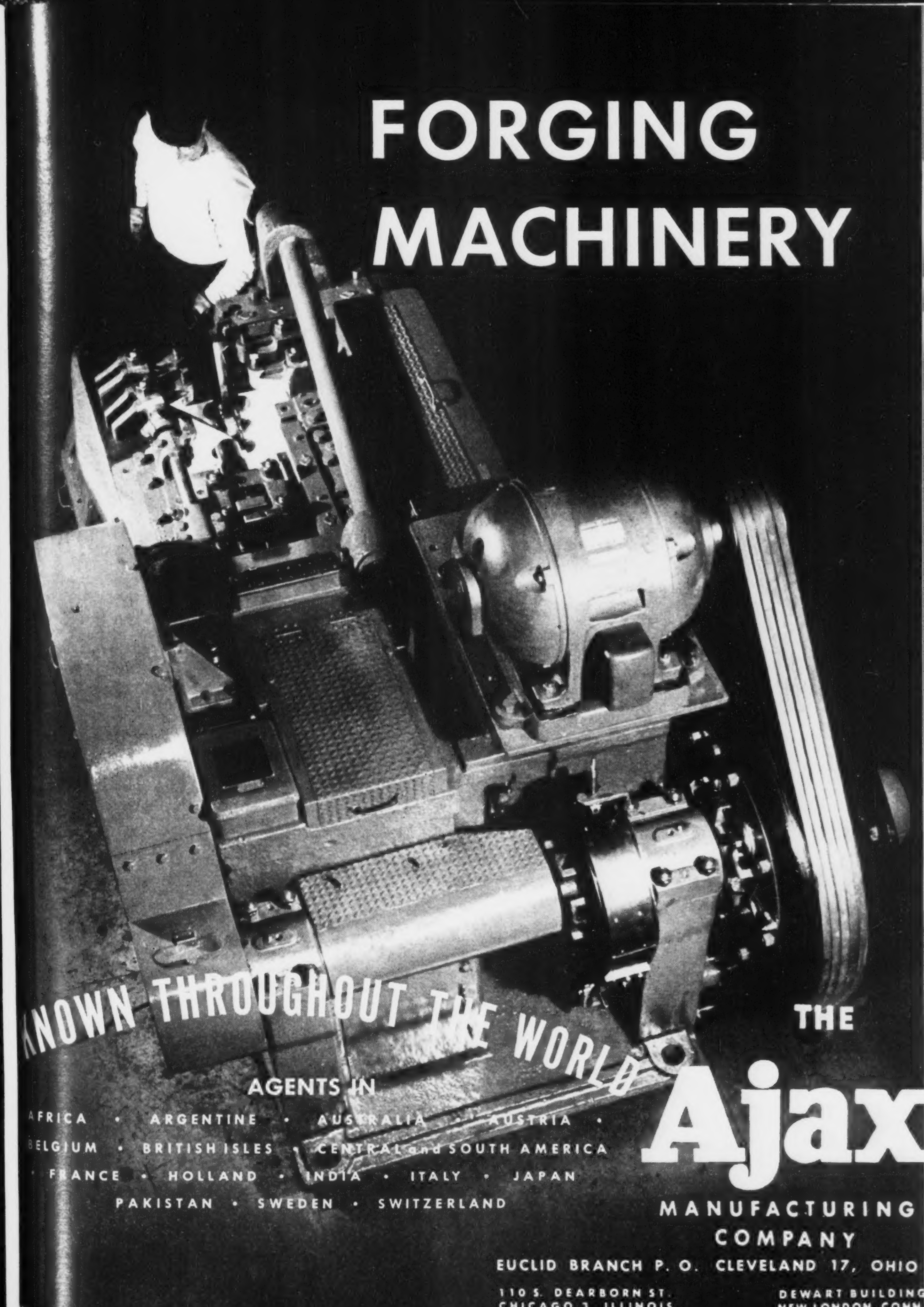
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DEWART BUILDING NEW LONDON, CONN.

—Technical Program—

Continued from Page 258

Effect of Carbon Content on 18-4-1 High Speed Steel — A. H. Grobe, research metallurgist, and G. A. Roberts, chief metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa.

Correlation of Machinability with Inclusion Characteristics in Resulphurized Bessemer Steels — L. H. VanVlack, process metallurgist, United States Steel Co., Pittsburgh.

Wednesday, Oct. 22, 9:30 a.m.

ASM ANNUAL MEETING

Edward DeMille Campbell Memorial Lecture

By Dr. Cyril Stanley Smith, Director Institute for the Study of Metals, Chicago, Ill.

Wednesday, Oct. 22, 2:00 p.m.

A Study of the Mechanism of the Delayed Yield Phenomenon — T. Vreeland, Jr., D. S. Wood and D. S. Clark, Department of Mechanical Engineering, California Institute of Technology, Pasadena, Calif.

Determination of Oxygen in Metals and Metal Oxides by the Isotopic Method—A. D. Kirshenbaum and A. V. Grosse, Research Institute of Temple University, Philadelphia.

The Indium-Arsenic System — T. S. Liu, Horizons, Inc., Cleveland, and E. A. Peretti, acting head, Department of Metallurgy, University of Notre Dame, Notre Dame, Ind.

Thursday, Oct. 23, 9:30 a.m.

MECHANICAL PROPERTIES

The Effect of Quenching and Tempering on Residual Stresses in Manganese Oil-Hardening Tool Steel—H. J. Snyder, research associate, Mellon Institute of Industrial Research, Pittsburgh.

X-Ray Measurement of Residual Stress in Hardened High Carbon Steel—A. L. Christenson, research metallurgist and E. S. Rowland, chief metallurgical engineer, Timken Roller Bearing Co., Canton, Ohio.

Turn Page

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The unusual uniformity of gauge in MicroRold allows for closer die setting, assuring the fabricator of uninterrupted production in stamping, forming and blanking operations.

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From edge to edge—and end to end—only MicroRold has such outstanding uniformity of gauge.

WASHINGTON STEEL CORPORATION

WASHINGTON, PENNSYLVANIA

—Technical Program—

Continued

The Endurance Limit of Temper Brittle Steel—R. D. Chapman, research metallurgist, and W. E. Jominy, chief metallurgist, Research, Chrysler Corp., Detroit.

Plastic Stress-Strain Relations of Alcoa 14S-T6 for Variable Biaxial Stress Ratios—Joseph Marin, professor of engineering mechanics, L. W. Hu and J. F. Hamburg, Dept. of Engineering Mechanics, Pennsylvania State College, State College, Pa.

Thursday, Oct. 23, 2:00 p.m.

TEMPER BRITTLENESS

The Effect of Various Heat Treating Cycles Upon Temper Brittleness—J. D. Jaffe and D. C. Buffum, Watertown Arsenal Laboratory, Watertown, Mass., and F. L. Carr, National Research Corp., Cambridge, Mass.

Effect of Hardness on the Level of the Impact Energy Curve for Temper Brittle and Unembrittled Steel—F. L. Carr, National Research Corp., Cambridge, Mass., M. Goldman, Battelle Memorial Institute, Columbus, L. D. Jaffe and D. C. Buffum, Watertown Arsenal Laboratory, Watertown, Mass.

Transverse Mechanical Properties in an SAE 1045 Forging Steel—A. H. Grobe, research metallurgist, Vanadium Alloys Steel Co., Latrobe,

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"One metallurgist!"

Technical Program

Continued

Pa., Cyril Wells, member of staff, and R. F. Mehl, director, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh.

The Determination of the Plastic Constants of Metals by the Ultrasonic Pulse Technique—M. B. Reynolds, Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N. Y.

Friday, Oct. 24, 9:30 a.m.

ELEVATED TEMPERATURE PROPERTIES

Temperature Dependence of the Hardness of Pure Metals—J. W. Westbrook, The Knolls, Research Lab., General Electric Co., Schenectady, N. Y.

Hardness of Various Steels at Elevated Temperatures—F. Garofalo, P. R. Malenock and G. V. Smith, Research Laboratory, United States Steel Co., Kearny, N. J.

Some Properties of a Nodular Iron at Elevated Temperatures—M. S. Saunders, graduate student, and M. J. Sinnott, associate professor of chemical and metallurgical engineering, University of Michigan, Ann Arbor, Mich.

Accelerated Strain Aging of Commercial Sheet Steels—L. R. Shoenberger, research engineer, and E. J. Paliwoda, research engineer, Jones & Laughlin Steel Corp., Pittsburgh.

AMERICAN WELDING SOCIETY

Monday, Oct. 20, 10 a.m.

ADAMS LECTURE

The Welding and Brazing of Titanium Alloys — C. B. Voldrich, Battelle Memorial Institute.

Monday, Oct. 20, 2:00 p.m.

(Three simultaneous sessions)

FABRICATING PROCEDURES

Fusion Welding Techniques for Jet Aircraft Components — Arnold S. Rose and Morton A. Braun, I. T. E. Circuit Breaker Co.

Should Preheat Be Substituted for High Temperature Stress Relief in the Codes? — E. Paul DeGarmo, University of California.

Turn to Page 364

—**Technical Program**—

Continued

Chromium-Recovery During Submerged-Arc Welding—James G. Kerr and David A. Elmer, C. F. Braun & Co.

RESISTANCE WELDING

Corrosion of Structural Spot Welds—B. Karnisky, E. P. Gruca and E. Kinelski, Pullman-Standard Car Mfg. Co.

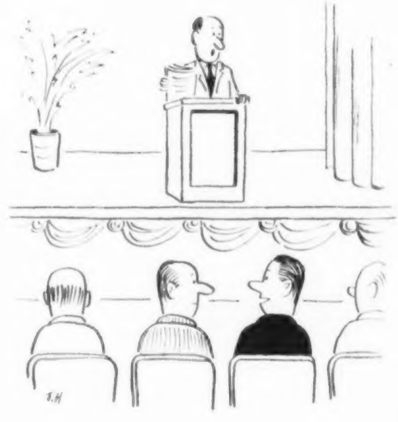
Maintenance of Resistance Welders in High Speed Assembly Lines—James F. Salatin and O. D. Etchison, Delco-Remy Div., General Motors Corp.

HARD FACING AND FLAME HARDENING

Hard Facing Alloys of the Chromium Carbide Type—Howard S. Avery and Henry J. Chapin, American Brake Shoe Co.

Selection and Evaluation of Methods of Hard Facing—Jack J. Barry, Air Reduction Sales Co.

Flame Hardening of Large Diameter Thin Wall Cylindrical Shells—G. S. Wing and G. A. Weber, M. W. Kellogg Co.



"It's over his head too."

Tuesday, Oct. 21, 9:30 a.m.
(Three simultaneous sessions)

RESISTANCE WELDING

Calculation of Spotweld Properties—Julius Heuschkel, Westinghouse Electric Corp.

Temperature Distribution During Flash Welding of Steel—Part I—

Ernest F. Nippes, Warren F. Savage, John J. McCarthy and Sheridan S. Smith, Rensselaer Polytechnic Institute.

Spot Welded Titanium-Base Alloy Sheet—M. L. Begeman and Frank W. McBee, Jr., The University of Texas.

Spot Welding Magnesium with Three Phase Low Frequency Equipment—Dean L. Knight and Paul Thorne, National Electric Welding Machines Co., and Paul Klein, Dow Chemical Co.

WELDABILITY

Further Studies of the Crack Sensitivity of Aircraft Steels—A. W. Steinberger and J. Stoop, Curtiss Wright Corp., Propeller Div.

Effect of Geometry on Stresses in Circular Patch Specimen—Alan V. Levy and Harry E. Kennedy, University of California.

Evaluation of the Circular Patch Weld Test—John E. Hackett and L. O. Seaborn, University of California.

Relationship of Welding Technique to Penetration and Dilution—Clarence E. Jackson and Arthur E. Shrubsall, Union Carbide and Carbon Research Labs.

STRUCTURAL

The Behavior of Welded Portal Frames—E. R. Johnston, Lynn S. Beedle, Fritz Engineering Labs., Lehigh Univ., and J. M. Ruzek, C. F. Braun & Co.

Residual Stress and the Compressive Strength of Steel—Lynn S. Beedle, A. W. Huber, Fritz Engr. Labs., Lehigh Univ., and Bruce G. Johnston, University of Michigan.

How to Save Cost by Designing for Structural Welding — Alfred E. Pearson, The Ingalls Iron Works Co.

Distortion Control in Structural Fabrication—Gordon Cape and Llewellyn Jehu, Dominion Bridge Co.

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Technical Program

Continued

Tuesday, Oct. 21, 2:00 p.m. (Three simultaneous sessions)

WELDABILITY

The Effect of Strain Rate on Twinning and Brittle Fracture in Low Carbon Steel—D. Rosenthal and C. C. Woolsey, Jr., University of California.

Interpretation of Test Data Regarding Brittle Strength and Transition Temperature of Structural Steel—N. M. Newmark and W. C. Heltje, University of Illinois.

Factors Affecting the Structural Steel in Repeated Overloading—Robert D. Stout, John H. Gross and Dogan Gucer, Lehigh University.

RESISTANCE WELDING

Quality Control of Resistance Welding by Statistical Methods—J. F. Radford and R. K. Waldvogel, Crosley Division, Avco Mfg. Corp.

Contact Resistance as Affected by Subdividing the Contact Area—Wm. B. Kouwenhoven and Clarence W. Little, Jr., The Johns Hopkins Univ.

New Multi-Spot Control Provides Increased Welding Production with Limited Power Supply—Claude R. Whitney, Jr., Square D. Co.

BRAZING AND BRONZE WELDING

New Aspects in Surface Alloying in Brazing and Related Techniques—

"I want you all to get into that Metal Show and fight."

Dr. Robert Humphrey and Rene D. Wasserman, Euctectic Welding Alloys Corp.

Strength Joints to Steel with Aluminum Bronze Filler Metals—Willis G. Groth, Ampco Metal, Inc.

Tuesday, Oct. 21, 4:30 p.m.
Educational Lecture Series

Inert Gas Metal Arc Welding Processes—Walter H. Wooding, Philadelphia Naval Shipyard.

Wednesday, Oct. 22, 9:30 a.m.
(Two simultaneous sessions)

NON-FERROUS

The Semiautomatic Inert-Gas Metal-Arc Welding of Aluminum Alloys—Charles T. Gayley, Joseph R. Girini and Walter H. Wooding, Industrial Test Laboratory, Philadelphia Naval Shipyard.

Welding 90-10 Cupro-Nickel by the Inert Gas Shielded Arc Processes—L. H. Hawthorne, Revere Copper and Brass, Inc.

Weld Cracking of Aluminum Alloys—James D. Dowd, Aluminum Co. of America.

WELDABILITY

Relation of Preheating to Low-Temperature Cooling Rate Embrittlement and Microcracking — A. E. Flanigan and T. Micleu, University of California.

Initiation and Propagation of Brittle Fracture in Structural Steels—Peter P. Puzak, Earl W. Eschbacher and William S. Pellini, Naval Res. Lab.

The Continuous Cooling Transformation of Weld Heat-Affected Zones W. R. Apblett, L. K. Poole and W. S. Pellini, Naval Research Lab.

The Determination of Optimum Welding Conditions for the Automatic Welding of High Hardenability Steels, With or Without Preheat—C. R. McKinsey and J. F. Collins, Union Carbide & Carbon Res. Labs., Inc.

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—Technical Program—

Continued

Wednesday, Oct. 22, 2:00 p.m. (Three simultaneous sessions)

WELDABILITY

Embrittlement of High Strength Ferritic Welds—Peter P. Puzak and William S. Pellini, Naval Research Laboratory.

Temper Brittleness in Low Alloy Weld Metal—Richard P. Wentworth and Hallock C. Campbell, Arcos Corp.

The Effects of Electrodes and Welding Conditions on the Ductility of Arc Welded Mild Steels—Ernest F. Nippes and Alexander Lesnewich, Rensselaer Polytechnic Institute.

NON-FERROUS

The Strength and Ductility of Welds in Aluminum Alloy Plate—F. M. Howell and F. G. Nelson, Jr., Aluminum Research Laboratories.

Factors Which Determine the Performance of Aluminum Alloy Weldments—W. R. Apblett, C. R. Felmley and W. S. Pellini, Naval Research Lab.

Welding and Forming of Titanium—Francis H. Stevenson, Aerojet Engineering Corp.

MAINTENANCE AND GAS CUTTING

Wear and Operation Problems in Maintenance—Frank J. Gaydos, U. S. Steel Co., Gary Works.

Effect of Oxygen Cutting on Alloy Steel—F. C. Saacke, Air Reduction Co., Inc.

Wednesday, Oct. 22, 4:30 p.m. Educational Lecture Series

Inert Gas Metal Arc Welding Processes—Walter H. Wooding, Philadelphia Naval Shipyard.

"Unusual atmosphere in Philadelphia, eh?"

Thursday, Oct. 23, 9:30 p.m.
(Three simultaneous sessions)

INERT ARC WELDING

A Comparison of Shielding Mixtures for Gas Shielded Arc Welding—John W. Cunningham, Air Reduction Sales Co.

Production Welding of Mild and Low Alloy Steels by Gas Shielded Arc Welding—John H. Berryman, Air Reduction Sales Co.

Porosity in Mild Steel Weld Metal—Donald Warren, E. I. du Pont de Nemours & Co., and R. D. Stout, Lehigh University.

BRAZING

Advanced Information for the Brazing Operator—E. F. Davis, Westinghouse Electric Corp.

Joint Design for Brazing—W. J. Van Natten, General Electric Co.

Technical Aspects of Soldering Practices—R. M. MacIntosh, Tin Research Institute, Inc.

Production Brazing — J. R. Wirt, Delco-Remy Div., General Motors Corp.

MARINE CONSTRUCTION

New Rules for Welding Low Alloy Ferritic Pipe Material — Commander Charles F. Perry, USCG.

Evaluation of Brittle Failure Re*search* — Paul Pfield and Ed Sweeney, Bethlehem Steel Company.

An Investigation on Peening—G. W. Place, American Bureau of Shipping.

Friday, Oct. 24, 9:30 a.m.
(Three simultaneous sessions)

PIPE

Pipe Welding in the Petroleum Refining Industry—Albert W. Zeuthen, Socony Vacuum Oil Company.

The Arc Welding of Low Chromium Molybdenum Steel Pipe—J. Bland, L. J. Privoznik and F. J. Winsor, Standard Oil Co. of Indiana.

Effect of Stresses and Stress Relief on the Bursting Strength of Circumferentially Welded Pipe—L. J. Privoznik and F. J. Winsor, Standard Oil Company of Indiana.

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—**Technical Program**—

Continued

INERT ARC

Inert Gas Shielding of the Metallic Arc—William L. Green and Robert J. Krieger, The Ohio State University.

Gas Flow Requirements for Inert Gas Arc Shielding—Glenn J. Gibson, Air Reduction Company, Inc.

Shielded Arc Welding of Jet Engine Components — K. H. Koopman, Linde Air Products Company.

MARINE CONSTRUCTION

Observations on Experience with Welded Ships — David P. Brown, American Bureau of Shipping.

Prevention of Marine Corrosion by Metallizing Systems — Howard Vanderpool, Metallizing Engineering Co.

Failure and Defects Encountered in Welded Ship Construction—Ralph D. Bradway, New York Shipbuilding Corp.

INSTITUTE OF METALS DIVISION—AIME

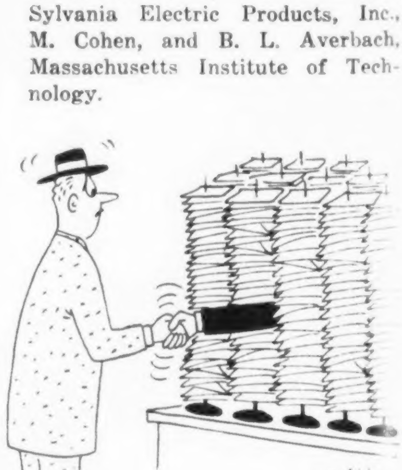
Monday, Oct. 20, 9:00 a.m.

THERMODYNAMIC AND THERMAL PROPERTIES

Scaling of Lead in Air—Elmer Weber, Chase Brass and Copper Co., and W. M. Baldwin, Jr., Case Institute of Technology.

Concentration Dependence of Diffusion Coefficients in Metallic Solid Solutions—D. E. Thomas, Westinghouse Atomic Power Division, and C. E. Birchenall, Carnegie Institute of Technology.

Thermodynamic Properties of Solid Nickel-Gold Alloys—L. L. Seigle, Sylvania Electric Products, Inc., M. Cohen, and B. L. Averbach, Massachusetts Institute of Technology.



"What makes you think we can't ship next week?"

ansformation in Cobalt-Nickel Alloys—J. B. Hess, Kaiser Aluminum and Chemical Corp., and C. S. Barrett, University of Chicago.

rinciples of Zone-Melting—W. G. Pfann, Bell Telephone Laboratories.

gregation of Two Solutes, with Particular Reference to Semiconductors—W. G. Pfann.

HIGH TEMPERATURE

Some Observations of Sub Grain Formation During Creep in High Purity Aluminum—I. S. Servi, Union Carbide & Carbon Corp., J. T. Norton and N. J. Grant, Massachusetts Institute of Technology.

Observations of Creep of the Grain Boundary in High Purity Aluminum—H. C. Chang and N. J. Grant, Massachusetts Institute of Technology.

Creep Correlations in Alpha Solid Solutions of Aluminum—O. D. Sherby and J. E. Dorn, University of California.

Effect of Zirconium on Magnesium-Thorium and Magnesium-Thorium-Cerium Alloys—T. E. Leontis, Dow Chemical Co.

Influence of Chemical Composition on the Rupture Properties at 1200°F of Wrought Cr-Ni-Co-Fe-Mo-W-Cb Alloys—E. E. Reynolds, Allegheny-Ludlum Steel Corp., and J. W. Freeman and A. E. White, University of Michigan.

High Temperature Oxidation of Some Iron Chromium Alloys—D. Caplan and M. Cohen, National Research Council, Ottawa.

Mechanical Properties of Intermetallic Compounds at Elevated Temperatures—Robert Lowrie, Lewis Flight Propulsion Laboratory.

Tuesday, Oct. 21, 9:00 a.m.

SYMPOSIUM ON TITANIUM AND TITANIUM ALLOYS DEFORMATION

Dynamic Formation of Slip Bands in Aluminum—N. K. Chen and R. B.

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—Technical Program—

Continued

Pond, Johns Hopkins University.

Observations on the Tension Texture of Aluminum—E. A. Calnan and Betty E. Williams, National Physical Laboratory.

Deformation of Zinc Bicrystals by Thermal Ratcheting—J. E. Burke and Anna M. Turkalo, General Electric Co.

Surface Effects in the Slip and Twinning of Metal Monocrystals—J. J. Gilman, and T. A. Read, Columbia University.

Bend Plane Phenomena in the Deformation of Zinc Monocrystals—J. J. Gilman, General Electric Co., and T. A. Read, Columbia University.

Kinking in Zinc Single Crystal Tension Specimens—Jack Washburn and E. R. Parker, University of California.

Tuesday, Oct. 21, 2:00 p.m.

SYMPOSIUM ON TITANIUM AND TITANIUM ALLOYS DEFORMATION—(Cont'd)

PHYSICAL METALLURGY

Development of Mechanical and Magnetic Hardness in a 10 pct Vanadium-Cobalt-Iron Alloy — R. W. Fountain, Union Carbide and Carbon Corp., and J. F. Libsch, Lehigh University.

Observations on Nodular Graphite—H. M. Weld, R. L. Cunningham, and F. W. C. Boswell, Department of Mines and Technical Surveys.

"The customers keep buying the new ones; this is the only thing we had around the shop."

Recrystallization Kinetics of Low Carbon Steel—S. F. Reiter, General Electric Co.

Effect of Molybdenum and of Nickel on the Rate of Nucleation and the Rate of Growth of Pearlite—R. W. Parcel, Rem-Cru Titanium, Inc., and R. F. Mehl, Carnegie Institute of Technology.

Effect of Applied Stress on the Martensitic Transformation — S. A. Kulin, Westinghouse Atomic Power Division, and M. Cohen, and B. L. Averbach, Massachusetts Institute of Technology.

A Study of Grain Shape in an Aluminum Alloy and Other Applications of Stereoscopic Microradiography—W. M. Williams, Revere Copper and Brass Co., and C. S. Smith, University of Chicago.

Wednesday, Oct. 22, 2:00 p.m.

TITANIUM

Titanium-Chromium Phase Diagram—F. B. Cuff, N. J. Grant, and C. F. Floe, Massachusetts Institute of Technology.

Titanium-Copper Binary Phase Diagram—A. Joukainen, E. I. du Pont de Nemours & Co., Inc., and N. J. Grant and C. F. Floe, Massachusetts Institute of Technology.

Titanium-Aluminum System—E. S. Bumps, H. D. Kessler, and M. Hansen, Armour Research Foundation of Illinois Institute of Technology.

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"I'm afraid you fellows have ruined the exhibit."

—**Technical Program**—

Continued

Observations on the Lattice Parameters of the Alpha and TiO Phases in the Titanium-Oxygen System—W. Rostoker, Armour Research Foundation of Illinois Institute of Technology.

Nature of the Line Markings in Titanium and Alpha Titanium Alloys—C. M. Craighead, G. A. Lenning, and R. I. Jaffee, Battelle Memorial Institute.

Time-Temperature-Transformation Characteristics of Titanium-Molybdenum Alloys—D. J. DeLazaro, M. Hansen, R. E. Riley, and W. Rostoker, Armour Research Foundation of Illinois Institute of Technology.

Compression Texture of Iodide Titanium—D. N. Williams, and D. S. Eppelsheimer, Missouri School of Mines and Metallurgy.

Partial Titanium-Vanadium Phase Diagram — Paul Pietrowsky, and Pol Duwez, California Institute of Technology.

CONSTITUTIONAL DIAGRAMS

Tungsten - Cobalt - Carbon System — Pekka Rautala, and J. T. Norton, Massachusetts Institute of Technology.

Role of the Binder Phase in Cemented Tungsten Carbide-Cobalt Alloys— Joseph Garland, Firth Sterling Steel & Carbide Corp., and J. T.

"It's a new model for the younger generation."

Norton, Massachusetts Institute of Technology.

Solubility of Carbon and Oxygen in Molybdenum—W. E. Few, and G. K. Manning, Battelle Memorial Institute.

System Molybdenum Boron and Some Properties of the Molybdenum Borides — Robert Steinitz, Ira Binder, and David Moskowitz, American Electro Metal Corp.

Systems Zirconium-Molybdenum and Zirconium-Wolfram — R. F. Domagala, D. J. McPherson, and M. Hansen, Armour Research Foundation of Illinois Institute of Technology.

Copper-Zinc Constitution Diagram Redetermined in the Vicinity of the Beta Phase by Means of Quantitative Metallography — Lillian Beck, and C. S. Smith, University of Chicago.

Intermediate Phases in the Mo-Fe-Co, Mo-Fe-Ni, and Mo-Ni-Co Ternary Systems—D. K. Das, Notre Dame University, S. P. Rideout, E. I. du Pont de Nemours Argonne National Laboratory, and P. A. Beck, University of Illinois.

SOCIETY FOR NON-DESTRUCTIVE TESTING

Monday, Oct. 20, a.m.

MODERN X-RAY EQUIPMENT

The General Electric Industrial Betatron—T. W. Dietze, General Engi-

Turn Page

"Sorry Bud, if you're not going to the Metal Show you're not going anywhere."

—Technical Program—

Continued

neering Laboratory, General Electric Co.

Modern Techniques in Precision High-Voltage Radiography — E. Alfred Burrill, High-Voltage Engineering Corp.

Uses of Low-Voltage X-Ray Tubes With Thin Beryllium Windows in Nondestructive Testing — Tom H. Rogers, Machlett Laboratories.

The Current Status of the Picker-Polaroid Process for One-Minute Radiography in the Industrial Field —W. B. Pyle, Picker X-Ray Corp.

Alternate: Direct Exposure Enlargement Techniques in Radiography and Fluoroscopy Utilizing Fractional-Focus X-Ray Tubes—Leo C. Kotraschek, North American Phillips Co., Inc.

Monday, Oct. 20, p.m.

NEW TECHNIQUES FOR X-RAY TESTS

Reduction of Exposure Time in Gamma Radiography—J. J. Hirschfield and D. T. O'Connor, Naval Ordnance Laboratory.

Techniques Used in Measuring Uniformity of Materials by Means of Gamma Radiation — Lawrence R. Megill and John N. Harris, Los Alamos.

Some Industrial Applications of Micro-Radiography — S. Goldspiel and F. Bernstein, N. Y. Naval Shipyard.

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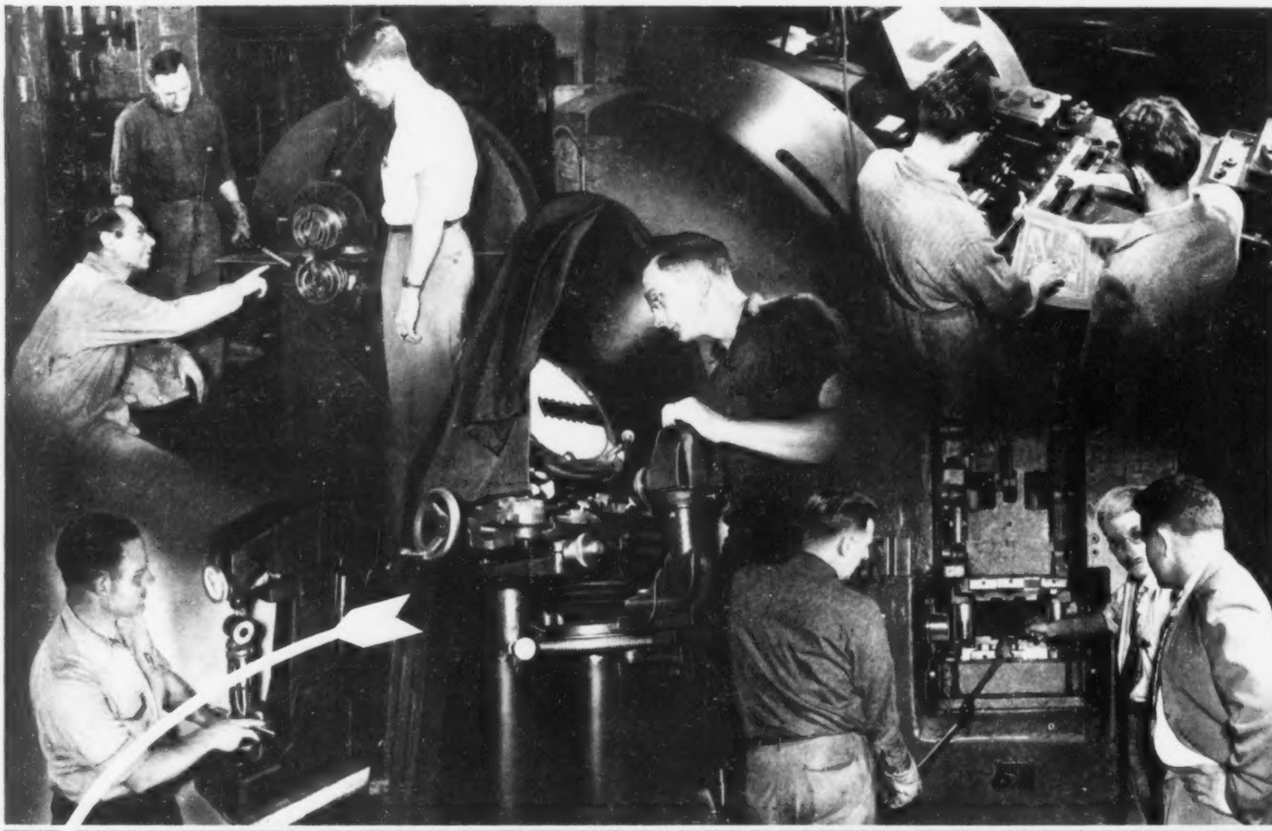
"The convention people are a little worrie about this demonstration."



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Technical Program

Continued

Gaging Tin Coatings in the Steel Industry by X-Ray Fluorescence Analysis—C. J. Woods, North American Phillips Co., Inc.

Alternate: Application of Fluorescence X-Rays to Metallurgical Microradiography — Herman E. Seeman and H. R. Splettstosser, Eastman Kodak Co.

Alternate: Radiography With Iridium 192—James V. Rigbey, Ford Motor Co. of Canada.

Tuesday, Oct. 21, a.m.

CONTROL AND INTERPRETATION IN X-RAY TESTING

Film Characteristics as Applied to Radiation Monitoring—George Corney, Eastman Kodak Co.

Problems of Mechanical Film Development—Donald F. Hauptman and Gerold H. Tenney, Los Alamos.

Various Penetrameter Types and Their Limitations — Norman C. Miller and Gerold H. Tenney, Los Alamos.

Interpretation of Radiographs of Aluminum and Magnesium Castings—J. J. Pierce, Naval Ordnance Laboratory.

Interpretation of Fluoroscopic Images of Aluminum and Magnesium Castings — D. T. O'Connor and D. Polaasky, Naval Ordnance Laboratory.

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—Technical Program—

Continued

Alternate: Semi-Empirical Equation for the Spectral Energy Distribution in X-Ray Beams—Charles R. Emigh, Los Alamos.

Tuesday, Oct. 21, p.m.

ECONOMICS OF NONDESTRUCTIVE TESTING

Economic Factors in Nondestructive Testing — W. E. Thomas, Vice-President, Magnaflux Corp.

Quality Control Application of Nondestructive Tests in the Airframe Industries Which Will Effectively Lower Production Costs — B. W. Clawson, Quality Manager, Douglas Aircraft, Inc.

The Use of Nondestructive Test Methods in Heavy Manufacture—James A. Pratt, Metallurgical Engineer, Westinghouse Electric Corp.

Wednesday, Oct. 22, a.m.

NEW ULTRASONIC TESTS

An Evaluation of New Immersion Ultrasonic Testing Techniques — Leslie W. Ball, U. S. Naval Ordnance Test Station.

Ultrasonic Examinations of Weldments and the Establishment of Safe Acceptable Limits for Defects Frank C. Parker, Carbide & Carbon Chemicals Co.

Ultrasonic Equipment for High-Precision Thickness Measurements—Peter K. Bloch, Vice-President, Branson Instrument Co.

Geophysics—Its Relation to Nondestructive Testing—Peter Dehlinger and Sam Wenk, Battelle Memorial Institute.

Alternate: Economic Industrial Applications of the Metroscope—Mr. Mann, Walter Kidde & Co.

Alternate: Future Trends in Industrial Ultrasonic Testing—William I. Bendz, Sperry Products, Inc.

—Technical Program—
Continued

Wednesday, Oct. 22, p.m.

NEW ELECTROMAGNETIC TESTS

Industrial Evaluation of Search Coil Flaw Detection Techniques—Carleton E. Hastings, Watertown Arsenal.

A Metal Comparator for the Inspection and Classification of Metals—B. M. Smith, General Engineering Laboratory, General Electric Co.

The Application of Foerster-Type Instruments in American Industry Representative of Magnaflux Corp.

Alternate: New Nondestructive Test Instruments — Friedrich Foerster, Institut-fur-Dr. Foerster, Germany.

Thursday, Oct. 23, a.m.

LIQUID-PENETRANT AND ELECTRICAL METHODS

Comparison of Materials for Liquid Penetrant Inspection — Hamilton Migel and Taber de Forest, Magnaflux Corp.

Lowering Production Costs With Dy-Chek and Chek-Spek Dye Penetrants — Representative of Turco Products, Inc.

The Application of Wire-Resistance Strain Gages to Lower Production Costs—Francis G. Tatnall, Baldwin-Lima-Hamilton Corp.

Alternate: The Measurement of Ionization in Dielectric Structures—a New Nondestructive Test for Electrical Insulating Materials—D. A. Lupfer, General Electric Co.

Thursday, Oct. 23, p.m.

MEHL HONOR LECTURE

Society for Nondestructive Testing Annual Lecture Honoring Dr. Robert F. Mehl—Donald T. O'Connor, Chief, Radiology Section, Naval Ordnance Laboratory.

Turn Page

STEEL: Workhorse Today and Tomorrow

Basic oxide reduction will stand, but new methods are gaining recognition . . . Low shaft furnace, greater use of oxygen enriched blast will yield superior steels tomorrow.

The world is producing iron at the rate of more than 200 million tons per year, for the most part as steel, and a small part as pig iron (about 20 million tons). Almost nine-tenths of the total pig iron produced, 150 million tons, is only an intermediate product, since it is converted into steel.

More than half the steel produced is obtained from pig iron, less than half from scrap. This ratio is slowly shifting in favor of scrap. Since some scrap is also used in pig iron production, nearly half of the iron production, taken in its entirety, is derived from scrap and the other half from iron ore. Annual requirements of iron ore amount to some 250 million tons, which take over 100 million tons of coke to smelt.

With the realization of these stupendous figures, iron production is proving more and more to be a problem of raw materials, just as indeed our whole life becomes more than ever dependent on materials found in the earth's crust.

Resources abundant only a few decades ago are nearing exhaustion. In the very near future the consumption of materials at the present rate will lead to a shifting of industries and to radical changes in our production methods. So far as concerns iron, this transformation has already begun on very modest lines; it will assume substantial shape before long.

In the broadest sense, man's task is to make the most rational use of the available raw materials, and to do so with an eye not only to the present but to the future. Unsystematic exploitation of resources is a crime against posterity. The problem for steelmakers is to transform present production methods to make the best possible use of available raw materials at our disposal.

Other Fuels—Fuel required for heating and reducing the charge in iron production need no longer be only coke, as it is today. The aim must be to be able to use any fuel, particularly as the over-all fuel reserves are also not inexhaustible, although much larger than those of coking coal.

With regard to ferrous raw materials iron production methods must be adapted to the characteristics of the raw materials. Since about 1/20 of the earth's crust consists of iron, supplies of our most important metal are practically unlimited. However, the lower the Fe content of the ores to be smelted, the greater are the impurities they contain, making the production process more and more difficult.

Investment Factor—Owing to

echnical progress over the last 20 to 30 yr we can now adapt our iron production methods to available raw materials. The changeover will take place gradually, if only because of the heavy capital investments in existing works.

There is no likelihood of any change, in the immediate future, in the principal method of iron production—reduction of the iron oxides. Thermal dissociation is out of the question, and electrolysis cannot be considered for mass-production purposes.

Fuel Supplements—The principal means of reduction will remain carbon in some form of fuel, although it may be supplemented to some extent by hydrogen here and there, especially in areas poor in coal and rich in natural gas.

Almost all ore delivered for smelting at the present time is first reduced to pig iron, which is converted into steel by further refining. In contrast to this "indirect" process, efforts have been made for a long time to find a "direct" process, as existed in the days of the catalan furnace.

Direct—These efforts are frequently made in the mistaken belief that production via pig iron is a roundabout method. But even direct methods yield only an intermediate product which must undergo a further process before becoming usable. This difference in the intermediate product is not the deciding factor; the vital point is which process is ultimately the cheaper.

In mass production, the answer is the indirect and less costly method from the economic point of view. This fact does not preclude the possibility that a really direct steel production process may yet be discovered that is also economically more direct. But dis-

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Prof. Robert Durrer of Zurich Polytechnicum and Director of the Louis de Roll Iron and Steel Works prepared the accompanying report on recent trends in the steel industry for the Economic Commission for Europe.

Steel of tomorrow promises to be superior product . . . Big defect in blast furnace is loss of the heat.

covery of such a method is rather unlikely.

Superior Product—Almost all ore is smelted today in blast furnaces. Almost all the liquid pig iron thus produced is converted into molten steel. So far as can be judged, this method of production will continue.

In the future, however, the intermediate product, so long as it is not used in foundries, will be far superior in composition to the pig iron of today. Accordingly, the subsequent refining process will have to be more flexible. Both processes, smelting and refining, will nevertheless be radically altered.

Defect—Fundamental defect in blast furnace smelting is the use of atmospheric air, since it leads to the production of vast quantities of gas, which draw off equally vast amounts of heat from the hearth in the direction of the top of the furnace.

In order that this heat can be substantially transferred from the rising gas to the descending charge, very high furnaces are required, up to almost 30 m high. Moreover, this height is required to make indirect reduction, reduction with oxide of carbon, as thorough as possible and thereby to lower coke consumption.

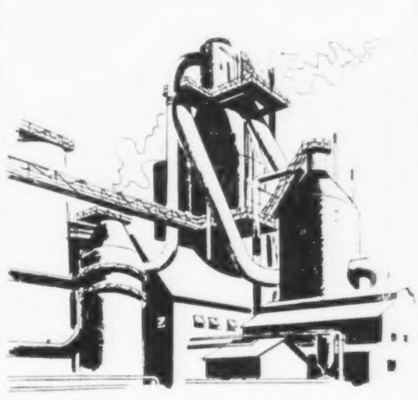
How Much Gas?—The less the specific quantity of gas, the less high need the furnace be, as electric smelting has shown in practice. Experience with the electric blast furnace, modeled on the coke blast furnace, that reduction takes place only at the bottom of the shaft led to introduction of the electric low-shaft furnace, which consists of no more than a hearth.

Although, other things being equal, a lower furnace is also cheaper, its greatest advantage is that it widens the limits of the raw

Must convert from high charge to low charge furnace . . . Would permit better use of raw materials.

materials that can be used. At one end of the scale is the blast furnace with its high shaft, i.e. the furnace with a very high charge (high-charge furnace), at the other, the low-charge furnace.

Low Charge Process—If we are to make fullest possible use of available raw materials we must go over from the high-charge to the low-charge process. The electric low-shaft furnace is a practical example of a low-charge furnace. But there are limits to its



uses because it operates on hydroelectric power, so that it can only replace the blast furnace to a minor extent.

The specific quantity of gas can be reduced although to a lesser extent than by the suppression of the blast (as in electric smelting) by the complete or partial elimination of nitrogen, and the shaft can be shortened at the same time. In this direction may lie the best prospects of development for the smelting of ferrous minerals with the help of any kind of solid fuel.

Blast furnaces are quite unsuitable for the reduction of ores with oxygen. Enrichment of the blast with oxygen has a favorable influence on production and coke consumption only as long as the temperature of the furnace gas remains well above 100°C. These advantages themselves are relatively small.

Continued

Chief advantage of oxygen achieved only in low-shaft furnace . . . Present furnaces have long life.

Add Oxygen—Chief advantage of reduction with oxygen cannot be achieved in blast furnaces, but only in low-shaft furnaces. This need not prevent the small advantages to be gained by the use of oxygen in existing blast furnaces which, it may be added, are similar to those achieved by increasing the pressure of the blast. Fundamental defects of blast furnaces can be mitigated, not removed.

Existing blast furnaces will be used for many years to come as the foremost smelting apparatus. The process for reduction with oxygen in low-shaft furnaces, proved in principle, should be worked out without delay, so it may be adopted as rapidly as possible.

Advantages — Metallurgical advantages of the oxygen low-shaft furnace apply not only to the production of iron, but also to other metals and alloys, particularly those with a high point of fusion. The ferroalloys which cannot be produced in blast furnaces should only be produced in the oxygen low-shaft furnaces, as soon as the process has been developed in practice and when the coal is cheaper than electricity per calorie.

The charge is even lower than

Low charge also used for smelting in rotary furnace . . . "Direct" processes show best results so far.

in the low-shaft furnace when it is spread in thin layers in the bath. Reaction conditions are ideal. Fine ore is reduced by an admixture of fuel or by the carbon in the bath or both. Heating takes place via the bath, e.g. by oxygen blast, the burnt carbon being replaced by charging more fuel. The idea is old, but it has never yet been put into practice. If the difficulties in the way, practical rather than fundamental, could be overcome, iron ores and coal fines could be used direct in iron production.

Smelting—An equally low charge is used for smelting in the rotary furnace where the material to be reduced is heated from the outside, while reduction takes place inside, as in the shaft furnace. The heating from outside is much less effective since it is slower and entails much loss as well as being very severe on the refractory-brick lining.

Heating is most efficient where heat is produced within the material to be heated, as in the case of the shaft furnace. Smelting in the rotary furnace is already being practiced in various forms. It has the advantage that it enables fine ores to be used. Possibilities of application, at present still limited, depend upon local conditions.

Excellent Results—Direct processes for steel production have already yielded excellent results, given suitable local conditions, if not for mass production, at any rate for the production of special kinds of iron. This is particularly true of the processes developed and employed in Sweden for the production of sponge iron.

In Sweden, with its magnificent resources in raw materials for iron production, the shortage of charcoal, best fuel and reducing agent, is becoming more and more acute. Its price has reached an exceptionally high level. It is

Turn Page

—Steelmaking trends—

Continued

Sponge iron a high grade scrap . . . Has no special virtue beyond its purity . . . Refining of scrap.

therefore becoming increasingly expensive to produce the world-famous Swedish charcoal pig iron.

Sponge Iron—Sponge iron can be used as a metallurgical substitute for charcoal pig iron in steel production, and if it can be produced cheaply enough its use is economically justified. It is a steel-like intermediate metal of extraordinary purity, when produced from pure or purified raw materials.

Sponge iron is therefore, first and foremost, a high-grade scrap which can be substituted for unreliable commercial scrap in steelmaking, when certain metallurgical qualities are required or when economically feasible. It is now being more widely used wherever its use can lower production costs.

There are already two plants in Sweden, one of which has been in operation for more than 10 yr. Others are under construction or planned. Such methods are also of special value in countries, like Venezuela, with rich ore and natural gas deposits.

No Special Virtue—The once commonly held view that steel produced from sponge iron is better, because of its purity, than that produced from scrap, is tenable if the scrap contains considerable impurities; but there is no ground for regarding sponge iron as superior merely because it is "virgin iron."

The mass production of steel is based on pig iron and scrap, i.e., on the one hand, by refining and removing most of the impurities from the pig iron and, on the other, by regenerating the scrap, which is already steel although not in usable form.

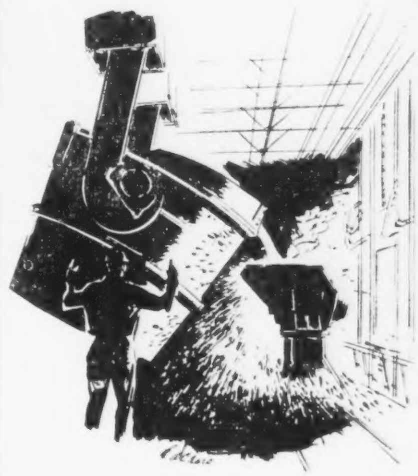
The refining mainly consists of burning out the impurities; the regeneration, in remelting the steel already there. The quickest and cheapest way of refining pig

Continued

Openhearth maintains place . . . Product usually superior to steels from other steelmaking methods.

iron is at present the air-blast method, i.e. oxidation with atmospheric oxygen.

Openhearth—A large proportion of the pig iron is nevertheless converted into steel by combining with oxygen in the openhearth furnace, which is a slow and expensive process. This essentially complicated method must be em-



ployed, since the hearth furnace is the scrap smelter par excellence and openhearth steel is in many respects superior to converter steel.

Cause of the inferiority of the converter process can be traced to the air blast. Under the present method, the nitrogen in the blast absorbs so much heat from the bath that the quantity of cold metal scrap that can be added is relatively negligible. So much nitrogen enters the steel that the latter contains more nitrogen.

Low in Nitrogen—By employing a blast rich in oxygen and a sufficiently low content of nitrogen, the heat normally absorbed by the nitrogen remains in the steel. The steel then has a lower nitrogen content than openhearth steel.

This process has already been proved in small converters, both

Turn Page

—Steelmaking trends—

Continued

Oxygen use not aimed at speeding up refining of steel bath . . . Big use is to aid in melting of scrap.

acid and basic. Tests have been made in an acid converter of 15 tons but there are still difficulties, although not of a fundamental character, in applying the process in a large basic converter. When these are overcome, most of the scrap now remelted in the openhearth furnace can be regenerated in the oxygen converter with the heat now lost due to the nitrogen in the air blast.

In the basic electric-steel furnaces where relatively small quantities of pig iron (about one-quarter compared to scrap) are used, the blowing of oxygen is already in regular operation.

Use of oxygen is aimed not at speeding up the refining of a bath of steel, as is done in openhearth and electric furnaces in many places, but to use the heat produced by the blowing of oxygen to melt the scrap and thereby correspondingly reduce electric consumption.

Scrap Reduction—Use of oxygen as indicated is a practical possibility and lays the basis for consideration of the use of the heat produced by the blowing of oxygen for melting scrap in the production of steel. When proved completely successful, all that is required for production of molten steel is a converter.

Where electric power is cheap and there is more scrap than pig

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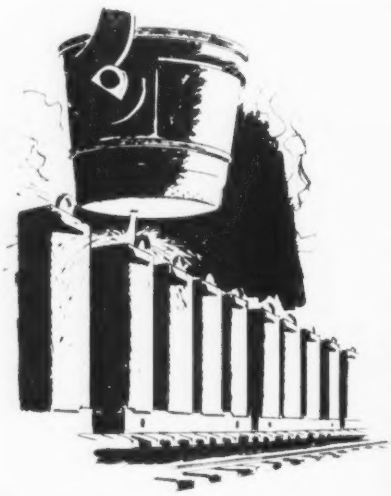
Essential to keep metal losses during treatment at a minimum . . . Peletization will have great value.

iron available, the electric steel furnace can function as a combined converter and electric furnace, consuming a small amount of electrical energy.

Transformation of iron production on the lines indicated will yield an intermediate metal of vastly different composition. It



will also have a marked effect on preliminary preparation of the materials. Main objective today is to adapt raw materials to the metallurgical processes.

Metal Losses—It is wiser to suit the methods of treatment to the raw materials. First essential is to keep metal losses during treatment to a minimum and, as far as possible, make treatment a part of the metallurgical process. The pelletization method now being developed may be of considerable value.

For these reasons, and owing to

—Steelmaking trends—

Continued

Higher silica content of less rich ores will affect product quality . . . Many new methods to be used.

the different composition of iron ores and fuels in the future, especially their higher silica content, the composition of the intermediate metal produced by smelting will differ substantially from normal pig iron.

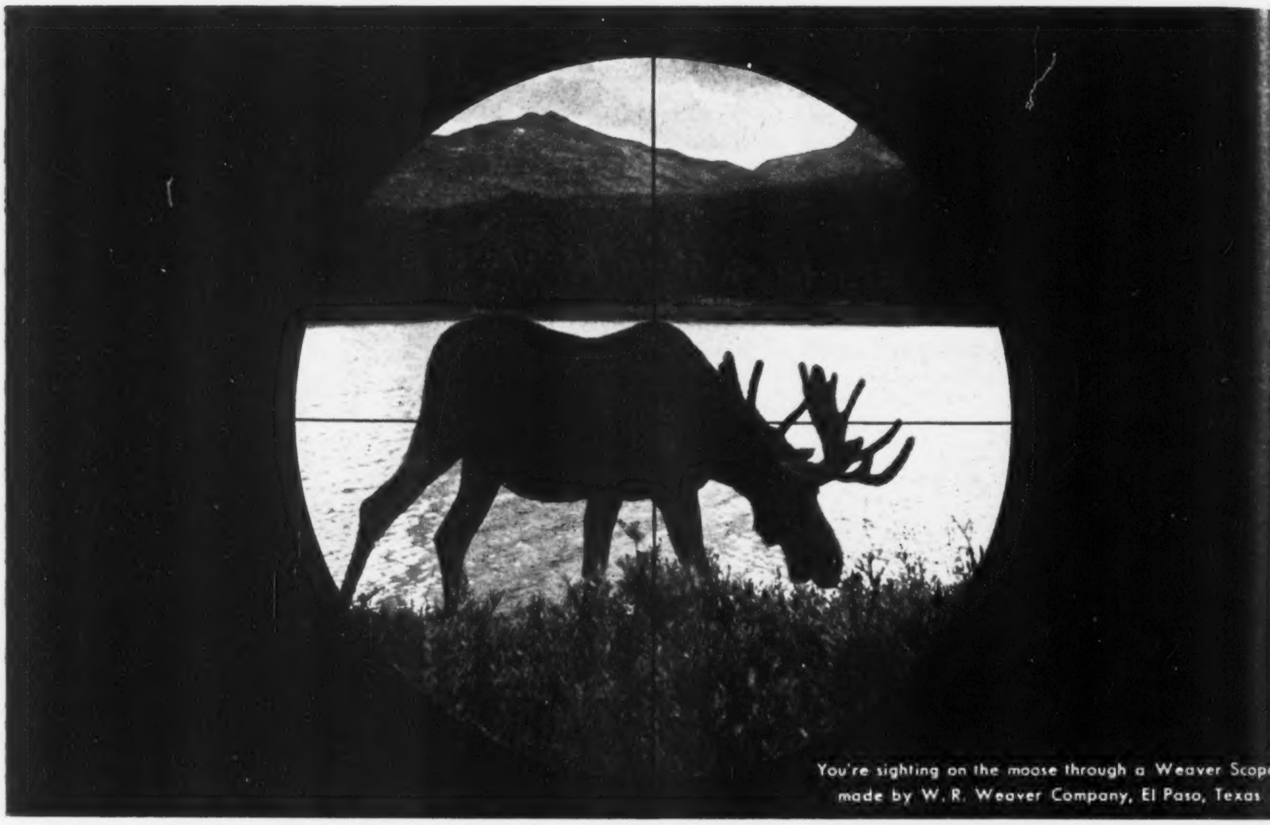
In particular, such metal will generally have a high silica content. This will not greatly complicate the application of oxygen-enriched blowing. Heat required to thoroughly reduce the silica will be released during blowing and therefore make it possible to feed more scrap to the furnace.

ADVANCEMENT OF RESEARCH

The 1952 ASM Medal for the Advancement of Research will go to Cleo F. Craig, President, American Telephone & Telegraph Co., New York. Founded in 1943 by the American Society for Metals, the Research Medal is based upon these qualifications which Mr. Craig fulfills to a high degree. The candidate shall be an executive in an industrial organization, the principal activity of which is the production and fabrication of metals. He shall be one who has consistently sponsored metallurgical research or development.

Metallurgical research forms an important part of the basic scientific studies carried on by the Bell System for the advancement of electrical communication.

During his long service as an engineer in the Bell System and as an executive in the management and in the operating and engineering activities, Mr. Craig has taken keen interest in the improvement and the extension of communication through research.



You're sighting on the moose through a Weaver Scope, made by W. R. Weaver Company, El Paso, Texas

Steel Catching Up With Strike-Caused Shortages

Output at 104 pct of capacity or better for the third straight week . . . Shipping facilities strained . . . Specialty items ease . . . Balanced market seen coming in second quarter of 1953.

The steel industry is making giant strides toward relieving intense pressure of demand which built up during the recent 2-month strike. For the third week in a row operations are scheduled at 104 pct of rated capacity or better. This represents an annual production rate of about 113 million net tons of raw steel (The all-time record was hung up last year when the industry turned out 105.1 million net tons of ingots and steel for castings).

Evidence of the terrific production pace is showing up in several places: (1) The market is more orderly; poststrike frenzy of consumers has abated. (2) Shipping facilities are being strained; spot shortages of freight cars are reported. (3) A number of consumers show signs of bumping into 30-day inventory restrictions; others eagerly take up the tonnage. (4) Specialty items—wire, straight-chrome grades of stainless sheets and strip, and silicon sheets are fairly easy; these items historically are among the first to reflect an easing market.

Market Forecast — The above signs are not interpreted to mean that steel supply is close to equalling demand. But they are the forerunners of a balanced market, which THE IRON AGE predicts will come during the second quarter of 1953. Before that a ding-dong battle is expected to develop over decontrol of steel distribution.

Steelmakers will not long acquiesce to controls when they are: (1) Producing the metal faster than consuming industries can chew it up, (2) pledged to a policy of not permitting any defense project to suffer from lack of steel, and (3) best qualified to distribute the remainder fairly among their civilian customers.

Why Not Decontrol?—Steel people have read between the lines of some recent statements from Washington, and they believe it is fantastic to suppose that standby control power should be left in the hands of the planners. They will argue that such authority belongs to Congress—and that it should no longer be delegated to administrative planners when the immediate emergency has passed.

But right now they are concentrating on production—particularly on bringing defense production up to date to offset strike losses. It looks as though military business will be caught up by the Nov. 30 deadline—earlier in a few items such as cold-rolled sheets. This will make more steel available for manufacturers of civilian goods.

Car Shortage—Due to emphasis on production and shipments, a shortage of freight cars has developed, especially in the Pittsburgh area. For many mills it's nip-and-tuck maintaining delivery schedules. Most have resorted to the practice of "making" cars by stepping up purchases of incoming materals, thus making more bottoms available for loading finished steel.

The freight car program has bogged down for lack of steel and railroads are lethargic about ordering new cars.

In their production battle steelmakers are getting a lift from a spurt of new capacity that is being completed. A large steel company is bringing in four new openhearth furnaces in the Cleveland area. At the same time another producer is bringing in four openhearths in the Chicago area. Within a period of no more than 6 or 8 weeks these two companies alone will have raised the industry's annual capacity some 1.5 million net tons.

Consumers Optimistic — Steel consumers show every indication of expecting business to continue at a very high level until at least the middle of next year. Though they are no longer panicky in trying to get steel, they are chafing under 30-day inventory restrictions. And some, including auto and appliance makers, are scheduling even higher production, despite the handicap of controls.

Auto production is now geared at almost 20 pct higher than the rate a year ago. In their efforts to boost output, automakers are running smack into a labor shortage in Detroit, an area whose unemployment problem climaxed a crisis in Washington not many months ago. In the face of a still very tight market they are planning to wind up steel conversion during February.

Warehouse Flurry — Warehouse business continues at a very high level. Although shipments of a good range of steel items are being received at a fast clip, there is little chance to rebuild depleted inventories—some hot items don't even get into inventory, being shipped straight to customers.

Steelmaking operations this week are scheduled at 104.5 pct of rated capacity, up half a point from last week. With new capacity coming in, the industry should be able to hold close to or better that high rate almost indefinitely, if demand warrants.

Market Briefs and Bulletins

Steel Consumption Mounting—Industry leaders say the South's steel consumption last year was more than double its 1940 rate. The increased consumption pace is expected to continue. Of all steel consumed, however, the South still accounts for only 11 pct and produces just 5 pct. On a population basis, it represents 25 pct of the U. S.

Factory Lay-offs Decline—Number of factory lay-offs during August averaged nine for every 1000 workers employed, about one-third the rate for August, 1951, reports Bureau of Labor Statistics. Factory hiring was one-fourth higher than a year ago, running at a rate of 57 per 1000 employees.

Pig Iron Drop—Mystic Iron Works, Everett, Mass., has reduced the base price of foundry pig iron for October, November and December. Price will be $59.25 instead of $59.75. Malleable will now be $59.25 instead of $60.25.

Same Pace—Western Europe's crude steel production during the second quarter nearly matched the record rate set in the first three months of this year. Output of countries outside the Iron Curtain was moving at an annual rate of 61.9 million metric tons compared with the 62,420,000 ton pace established in the first quarter, according to United Nations Economic Commission.

Purchase Manganese — Defense Materials Procurement Agency says it is now ready to receive shipments of manganese ore at its new purchase depots at Wenden, Ariz. Government specs call for ore with a maximum copper-lead-zinc content of 1 pct. Copper content may not be more than 0.25 pct. Ores with higher lead and zinc content are accepted if they can be nodulized to meet requirements.

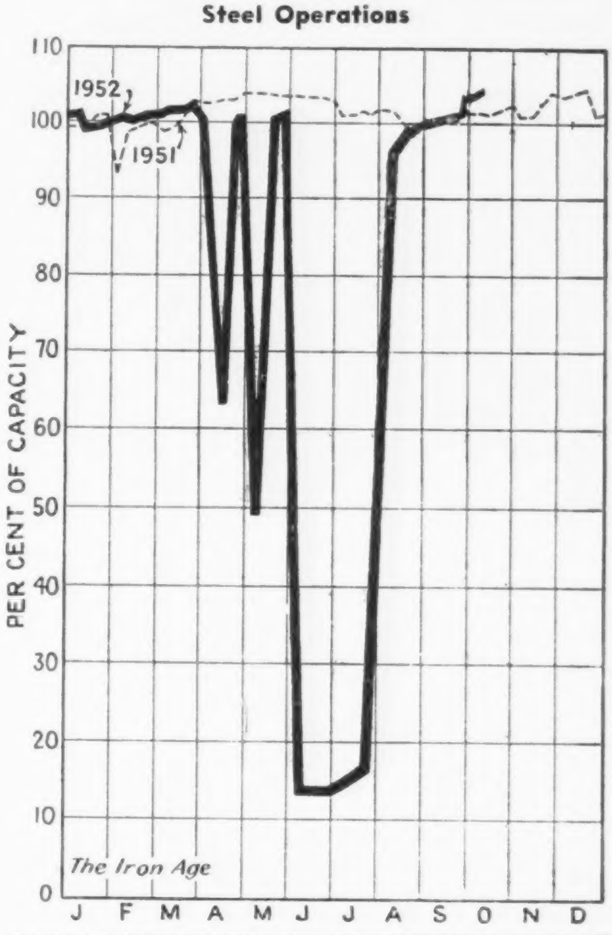
Wage Hike—Approximately 18,000 non-union employees of Westinghouse Electric Corp. have been granted a pay boost. Increase, if approved by the government, will raise wages of hourly-paid employees 7½¢ to 13¢ per hr. Clerical workers will receive a $13 to $22.55 per month wage hike. Supervisory, administrative and professional employees will get a 4 pct increase.

New Pipeline—Consolidated Western Steel Div., U. S. Steel Co., has completed an agreement under which Ebasco Services, Inc., New York, will supply about 40 pct of the 210,000 tons of steel pipe needed for a 960 mile crude oil pipeline to be laid down between Wink, Tex., and Norwalk, Calif.

Coal, Coke Rise—Anthracite coal prices may be raised 20¢ per net ton f.o.b. mines, and coke ceilings may be adjusted as a result of two government actions. Office of Price Stabilization hopes that during the 45-day coverage of the coke pricing order the industry will be able to furnish information needed for a permanent price adjustment.

Mill Expansion—Mill enlargement designed to increase stainless pipe and tubing capacity 40 pct has been started at Carpenter Steel Co.'s Alloy Tube Div., Union, N. J. The new mill addition is expected to be in production by the third quarter of 1953.

Steel Operations



District Operating Rates—Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	West	Buffalo	Cleveland	Detroit	Wheeling	South	Ohio River	St. Louis	East	Aggregate
Sept. 28	106.0*	106.5	106.0*	100.0	105.0	104.5	103.0*	109.0	100.0	101.0	90.0	108.0	93.5	104.0
Oct. 6	107.0	106.0	105.0	100.0	103.0	104.5	106.5	106.0	100.0	101.0	93.0	108.1	113.5	104.5

Beginning Jan. 1, 1952, operations are based on annual capacity of 108,587,670 net tons.
* Revised.

Aluminum Output Losses Mount

Tennessee Valley dry spell caps a tough year . . . Primary and secondary losses total 55,000 tons in second half . . . Demand up . . . Speed essential in third round—By *R. L. Hatschek.*

Production difficulties in the aluminum industry are mounting even higher. It's already been a hard-luck year with production losses due to storms, steel strike and another low-water season in the Pacific Northwest. Now Tennessee Valley power has been cut as a result of dry weather. Loss will total 4000 tons this month in the Southeast and could continue at 4000 tons a month until the end of the year if the rains don't fall.

The industry fell short of third quarter goals by 25,000 tons and will probably drop 30,000 tons of production in the fourth quarter of 1952, according to National Production Authority. The agency even has some doubts about full production during the first quarter of next year. And 1952 was originally slated to be the first million-ton year in the history of the U. S. primary aluminum industry.

Trim Estimates—Original third quarter estimates put the supply at 362,000 tons, according to administrator R. A. McDonald. But this had to be trimmed to 337,500 tons on account of the steel strike's disruption of the expansion, a tornado at Massena, N. Y., and construction and technical delays.

For the fourth quarter, NPA had expected production amounting to 381,000 tons and had slated more than 15,000 tons for the stockpile. But loss of hydroelectric power stepped in to compound the industry's troubles.

May Hold Stockpile—It is apparent, NPA explains, that fourth quarter supply will not be more than 350,000 tons — less if the water shortage continues another month or more. Stockpiling may have to go over. Industry is practically pleading to hold off new stockpiling until sometime next year.

For the first quarter NPA had anticipated a rising output of as much as 405,000 tons. But with lower output in the third and fourth quarters, scrap generation and recovery have slacked off. Nor will new capacity be ready according to the original timetable. Estimate has now been revised to an output of perhaps 387,500 tons for the first 3 months of 1953.

Demand Rebounds — According to the government survey, demand which had sagged slightly is on the boom side again. Fourth quarter orders are picking up and attrition is falling off. This can be partly attributed to resumption of manufacturing operations which were slowed by a lack of steel during and after the strike.

Another factor pushing up demand for the light metal was the expectancy of a plentiful supply by the end of this year. Who could have foreseen the varied assortment of gremlins plaguing production? Washington pushed aluminum as a substitute metal.

Still More Capacity—Munitions Board, in July, substantially increased its stockpile goal and Washington has been kicking around the idea of a third round of expansion ever since. Now the 200,000-ton-a-year goal, based on stockpile plans, has been announced (See p. 200). Emphasis is put on speed in getting the new expansion into production. Target date for completion is Jan. 1, 1955, but the planners would like it now if they could get it.

New Producers—Trying to kill more than one bird, the government wants new producers in this round. Most prominently mentioned in the picture are Kennecott Copper Co. and Olin Industries, Inc., with Spartan Aircraft Co. a lesser possibility. Trouble now is that Justice Dept. is getting choosy again and is at least morally opposed to Kennecott's getting a share. It was similar with Anaconda Copper Mining Co. but that firm is now building a smelter at Columbia Falls, Mont.

Where the new capacity would be located is not known; nor is it known what power source would be used. But it has been rumored that Olin might be the outfit to build a coal-fired plant in West Virginia as mentioned by Sen. Harley M. Kilgore.

Better Not Wait—With rapid erection the prime consideration. Defense Production Administration would probably pass up the newcomers if they don't get on the bandwagon soon. The big three would all like to expand their capacities further and Aluminum Co. of America—which figures it would be the last one asked—is itching to get started on its Alaskan smelter. If approached, Alcoa would ask for this to be put through.

NONFERROUS METAL PRICES

	Oct. 1	Oct. 2	Oct. 3	Oct. 4	Oct. 6	Oct. 7
Copper, electro, Conn.	24.50	24.50	24.50	24.50	24.50	24.50
Copper, Lake delivered	24.625	24.625	24.625	24.625	24.625	24.625
Tin, Straits, New York	\$1.21⅜	\$1.21½	\$1.21⅜	. . .	\$1.21⅜	\$1.21⅜*
Zinc, East St. Louis	13.75	13.75	13.75	13.75	13.75	13.75
Lead, St. Louis	15.80	15.80	15.80	15.80	15.80	15.80

Note: Quotations are going prices.
*Tentative.

Nonferrous Prices

MILL PRODUCTS

(Cents per lb, unless otherwise noted)

Aluminum

(Base 30,000 lb, f.o.b. ship. pt. frt. allowed)

Flat Sheet: 0.188 in., 2S, 3S, 31.6¢; 4S, 61S-O, 33.6¢; 52S, 35.8¢; 24S-O, 24S-OAL, 34.5¢; 75S-O, 75S-OAL, 41.9¢; 0.081 in., 2S, 3S, 32.8¢; 4S, 61S-O, 35.2¢; 52S, 37.4¢; 24S-O, 24S-OAL, 35.8¢; 75S-O, 75S-OAL, 43.9¢; 0.032 in., 2S, 3S, 34.5¢; 4S, 61S-O, 39.0¢; 52S, 41.8¢; 24S-O, 24S-OAL, 43.8¢; 75S-O, 75S-OAL, 54.8¢.

Plate ¼ in. and Heavier: 2S-F, 3S-F, 29.7¢; 4S-F, 31.7¢; 53S-F, 33.4¢; 61S-O, 32.3¢; 24S-O, 24S-OAL, 34.0¢; 75S-O, 75S-OAL, 40.7¢.

Extruded Solid Shapes: Shape factors 1 to 5, 35.5¢ to 77.2¢; 12 to 14, 36.2¢ to 93.5¢; 24 to 26, 38.7¢ to $1.22; 36 to 38, 45.9¢ to $1.79.

Rod, Rolled: 1.064 to 4.5 in., 2S-F, 3S-F, 39.4¢ to 35.2¢; cold-finished, 0.375 to 3 in., 2S-F, 3S-F, 42.5¢ to 36.8¢.

Screw Machine Stock: Rounds, 11S-Ts, ⅛ to 11/32 in., 56.2¢ to 44.1¢; ⅜ to 1½ in., 43.6¢ to 41.0¢; 1 9/16 to 3 in., 40.4¢ to 37.8¢; 17S-Ts, 1.6¢ per lb lower. Base 5000 lb.

Drawn Wire: Coiled, 0.051 to 0.374 in., 2S, 41.5¢ to 30.5¢; 52S, 50.4 to 36.8¢; 56S, 53.6¢ to 44.1¢; 17S-T4, 56.7¢ to 39.4¢; 61S-T4, 50.9¢ to 38.9¢.

Extruded Tubing: Rounds, 63S-T5, OD in in.: 1¼ to 2, 38.9¢ to 56.7¢; 2 to 4, 35.2¢ to 47.8¢; 4 to 6, 35.7¢ to 43.6¢; 6 to 9, 36.2¢ to 45.7¢.

Roofing Sheet: Flat, 0.019 in., x 28 in., per sheet, 72 in., $1.199; 96 in., $1.598; 120 in., $1.997; 144 in., $2.398. 0.24 in. x 28 in., 72 in., $1.448; 96 in., $1.931; 120 in., $2.414; 144 in., $2.897. Coiled sheet: 0.019 in. x 28 in., 26.6¢ per lb; 0.024 in. x 28 in., 28.2¢ per lb.

Magnesium

(F.O.B. mill, freight allowed)

Sheet and Plate: FS1-O, ¼ in., 63¢; 3/16 in., 65¢; ⅛ in., 67¢; B & S Gage 10, 68¢; 12, 72¢. Specification grade higher. Base: 30,000 lb.

Extruded Round Rod: M, diam in., ¼ to 0.311 in., 74¢; ½ to ¾ in., 57.5¢; 1¼ to 1.749 in., 53¢; 2½ to 5 in., 48.5¢. Other alloys higher. Base up to ¾ in. diam, 10,000 lb; ¾ to 2 in., 20,000 lb; 2 in. and larger, 30,000 lb.

Extruded Solid Shapes, Rectangles: M. In weight per ft, for perimeters less than size indicated, 0.10 to 0.11 lb, 3.5 in., 62.3¢; 0.22 to 0.25 lb, 5.9 in., 59.3¢; 0.50 to 0.59 lb, 8.6 in., 56.7¢; 1.8 to 2.59 lb, 19.5 in., 53.8¢; 4 to 6 lb, 28 in., 49¢. Other alloys higher. Base, in weight per ft of shape: Up to ½ lb, 10,000 lb; ½ to 1.80 lb, 20,000 lb; 1.80 and heavier, 30,000 lb.

Extruded Round Tubing: M, wall thickness, outside diam, in., 0.049 to 0.057; ¼ in. to 5/16, $1.40; 5/16 to ⅜, $1.26; ½ to ⅝, 93¢; 1 to 2 in., 76¢; 0.165 to 0.219, ⅝ to ¾, 61¢; 1 to 2 in., 57¢; 3 to 4 in., 56¢. Other alloys higher. Base, OD in in.: Up to 1½ in., 10,000 lb; 1½ in. to 3 in., 20,000 lb; 3 in. and larger, 30,000.

Titanium

(10,000 lb base, f.o.b. mill)

Commercially pure and alloy grades: Sheets and strip, HR or CR, $15; Plate, HR, $12; Wire, rolled and/or drawn, $10; Bar, HR or forged, $6; Forgings, $6.

Nickel and Monel

(Base prices, f.o.b. mill)

	"A" Nickel	Monel
Sheets, cold-rolled	77	60½
Strip, cold-rolled	83	63½
Rods and bars	73	58½
Angles, hot-rolled	73	58½
Plates	75	59½
Seamless tubes	106	93½
Shot and blocks	..	53½

Copper, Brass, Bronze

(Freight prepaid on 200 lb)

	Sheet	Rods	Extruded Shapes
Copper	45.52	....	45.12
Copper, h-r	....	41.37	..
Copper, drawn	..	42.62	
Low brass	42.34	42.03	..
Yellow brass	40.17	39.86	....
Red brass	43.10	42.79	....
Naval brass	44.72	38.78	40.04
Leaded brass	..	..	38.02
Com's bronze	44.39	44.08	....
Mang. bronze	48.44	42.83	43.89
Phos. bronze	64.72	64.97	
Muntz metal	42.69	38.25	39.50
Ni silver, 10 pct	51.96	54.18	....

PRIMARY METALS

(Cents per lb, unless otherwise noted)

Aluminum ingot, 99+%, 10,000 lb, freight allowed	20.00
Aluminum pig	19.00
Antimony, American, Laredo, Tex.	39.00
Beryllium copper, 3.75-4.25% Be	$1.56
Beryllium aluminum 5% Be, Dollars per lb contained Be	$69.50
Bismuth, ton lots	$2.25
Cadmium, del'd	$2.00
Cobalt, 97-99% (per lb)	$2.40 to $2.47
Copper, electro, Conn. Valley	24.50
Copper, Lake, delivered	24.625
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$2.25
Iridium, dollars per troy oz.	$200
Lead, St. Louis	15.80
Lead, New York	16.00
Magnesium, 99.8+%, f.o.b. Freeport, Tex., 10,000 lb.	24.50
Magnesium, sticks, 100 to 500 lb.	42.00 to 44.00
Mercury, dollars per 76-lb flask, f.o.b. New York	$193 to $195
Nickel electro, f.o.b. N. Y. warehouse	59.58
Nickel oxide sinter, at Copper Creek, Ont., contained nickel	52.75
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per troy oz.	$90 to $93
Silver, New York, cents per oz.	83.25
Tin, New York	$1.21⅜
Titanium, sponge	$5.00
Zinc, East St. Louis	13.75
Zinc, New York	14.58
Zirconium copper, 50 pct	$6.20

REMELTED METALS

Brass Ingot

(Cents per lb, delivered carloads)

85-5-5-5 ingot	
No. 115	27.25
No. 120	26.75
No. 123	26.25
80-10-10 ingot	
No. 305	33.00
No. 315	30.50
88-10-2 ingot	
No. 210	41.50
No. 215	40.00
No. 245	34.50
Yellow ingot	
No. 405	23.25
Manganese bronze	
No. 421	30.50

Aluminum Ingot

(Cents per lb, 100,000 lb and over)

95-5 aluminum-silicon alloys	
0.30 copper, max.	20.6
0.60 copper, max.	20.4
Piston alloys (No. 122 type)	20.5
No. 12 alum. (No. 2 grade)	19.5
108 alloy	20.6
195 alloy	20.8
13 alloy (0.60 copper max.)	20.8
ASX-679	20.5

Steel deoxidizing aluminum, notch-bar granulated or shot

Grade 1—95-97½%	18.80
Grade 2—92-95%	18.60
Grade 3—90-92%	18.40
Grade 4—85-90%	18.20

ELECTROPLATING SUPPLIES

Anodes

(Cents per lb, freight allowed, 500 lb lots)

Copper	
Cast, oval, 15 in. or longer	37.84
Electrodeposited	33⅜
Flat rolled	38.34
Forged ball anodes	43
Brass, 80-20	
Cast, oval, 15 in. or longer	34⅜
Zinc, oval	26½
Ball, anodes	25½
Nickel, 99 pct plus	
Cast	76.00
Rolled, depolarized	77.00
Cadmium	$2.15
Silver 999 fine, rolled, 100 oz lots, per troy oz, f.o.b. Bridgeport, Conn.	97¼

Chemicals

(Cents per lb, f.o.b. shipping points)

Copper cyanide, 100 lb drum	63
Copper sulfate, 99.5 crystals, bbl.	12.85
Nickel salts, single or double, 4-100 lb bags, frt. allowed	27½
Nickel chloride, 375 lb drum	27½
Silver cyanide, 100 oz lots, per oz.	67¼
Sodium cyanide, 96 pct domestic 200 lb drums	19.25
Zinc cyanide, 100 lb drum	47.7

SCRAP METALS

Brass Mill Scrap

(Cents per pound, add ½¢ per lb for shipments of 20,000 to 40,000 lb; add 1¢ for more than 40,000 lb)

	Heavy	Turnings
Copper	21½	20⅞
Yellow brass	19⅛	17⅞
Red brass	20⅛	19⅝
Comm. bronze	20½	19⅞
Mang. bronze	18½	17⅜
Brass rod ends	18⅞	...

Custom Smelters' Scrap

(Cents per pound, carload lots, delivered to refinery)

No. 1 copper wire	19.25
No. 2 copper wire	17.75
Light copper	16.50
Refinery brass	17.25*
Radiators	14.75

* Dry copper content.

Ingot Makers' Scrap

(Cents per pound, carload lots, delivered to refinery)

No. 1 copper wire	19.25
No. 2 copper wire	17.75
Light copper	16.50
No. 1 composition	18.50
No. 1 comp. turnings	18.25
Rolled brass	15.50
Brass pipe	16.50
Radiators	14.75

Aluminum

Mixed old cast	9 — 9⅜
Mixed new clips	10 —11
Mixed turnings, dry	9 — 9⅛
Pots and pans	8½— 9

Dealers' Scrap

(Dealers' buying price, f.o.b. New York in cents per pound)

Copper and Brass

No. 1 heavy copper and wire	18¾—19¼
No. 2 heavy copper and wire	17 —17½
Light copper	15½—16
New type shell cuttings	15½—16
Auto radiators (unsweated)	14 —14¼
No. 1 composition	17½—18
No. 1 composition turnings	17 —17½
Unlined red car boxes	16½—17
Cocks and faucets	15 —15½
Mixed heavy yellow brass	11½—12
Old rolled brass	14½—15
Brass pipe	15½—16
New soft brass clippings	16 —16½
Brass rod ends	15½—16
No. 1 brass rod turnings	15 —15½

Aluminum

Alum. pistons and struts	6½— 7
Aluminum crankcases	7½— 7¾
2S aluminum clippings	10 —10½
Old sheet and utensils	7½— 8
Borings and turnings	5 — 6
Misc. cast aluminum	7½— 8
Dural clips (24S)	7½— 8

Zinc

New zinc clippings	8 — 8½
Old zinc	5½— 6
Zinc routings	3¾— 4¼
Old die cast scrap	4¾— 5

Nickel and Monel

Pure nickel clippings	35 —36
Clean nickel turnings	35 —36
Nickel anodes	35 —36
Nickel rod ends	35 —36
New Monel clippings	28 —29
Clean Monel turnings	20 —21
Old sheet Monel	28 —29
Nickel silver clippings, mixed	13 —14
Nickel silver turnings, mixed	12 —13

Lead

Soft scrap, lead	12½—13
Battery plates (dry)	7 — 7½
Batteries, acid free	4 — 5

Magnesium

Segregated solids	15 —16
Castings	14 —15

Miscellaneous

Block tin	100
No. 1 pewter	70
No. 1 auto babbitt	55 —60
Mixed common babbitt	14½—14¾
Solder joints	19 —20
Siphon tops	60
Small foundry type	19 —19½
Monotype	15½—16
Lino. and stereotype	13½—14
Electrotype	12 —12½
Hand picked type shells	9¾—10
Lino. and stereo. dross	7
Electro. dross	6½

Are You Stocking Any 'Distress' Scrap?

May issue some licenses to export scrap if economic distress can be proven and certified by NPA . . . Any scrap so classed must first be offered to England . . . What about cast?

If a scrap dealer can get National Production Authority to certify that he is holding "distress" stocks, he may be able to get a license to export this material from Office of International Trade.

Export licenses covering the fourth quarter quota of 36,000 tons have already been issued. Bulk of this scrap will go to Mexico, traditionally dependent on the U. S.

A few licenses may be issued if the holder can prove "extreme economic hardship." Such licenses won't be granted unless the scrap cannot be sold in the U. S. at a reasonable price. In granting "distress" certification, NPA will consider how long the scrap has been in inventory and who is the customer.

Any scrap certified by NPA as "distress" must first be offered to England. Reason is that the U. S. is still short of meeting its promised scrap shipments under the Steel Exchange Agreement.

Cast grades may be the first affected by the OIT "distress" ruling. Some dealers say they can get fair prices for cast on small lot sales but shipments are very lean. Sluggishness in cast is a long-term affliction of many scrap centers. And it may be possible to claim eligibility under the "distress" clause on the basis that cast won't move at fair prices—and many times at any price.

Pittsburgh—Inventory of yard scrap in the area is thin. Reports here and from other districts indicate this situation is widespead. Mill inventories generally are ample, but some electric furnace mills apparently are scraping bottom of the barrel. An independent consumer bought a limited tonnage of openhearth material on $5 springboard. A large mill is expected to come into the market this week. Cast market is tending toward weakness.

Chicago—Steelmaking grades continued to move well here last week. There was some apprehension over blast furnace grades and a number of reports of difficulty in moving electric furnace grades. Cast continued off. Despite increasing mill inventories, however, openhearth scrap was firm and moving well. At the dealer level there was considerable eagerness to cover orders for the next 2 weeks, apparently in the belief that there might be a weakening in No. 2 heavy melting and No. 2 bundles during that period. There was no confirmation of this expected weakening in sales reported here.

Philadelphia—Some of the larger consumers of foundry grades in this area are beginning to get inventory-conscious. Result is that buying of cast scrap has dropped off lately. Steel mills are also reported reluctant to purchase either charging box cast or heavy breakable. Blast furnace grades remain at ceiling but less interest is being shown in short shovelings. Electric furnace and openhearth material moves along with no pushing from well-stocked buyers.

New York — The market here was stable. Steelmaking grades held their strength although consumers pursued non-aggressive purchasing policies. Stockpiles of scrap remained high. Some shippers in this area complain bitterly over the shortage of freight cars and say the situation is now worse than at anytime before. Cast continued weak.

Detroit—Scrap continues in good demand with most of the market strength coming from consumers within the area. The artificial shortage here is still part of the steel strike hangover when a non-striking mill prevented build-up of inventories. A lot of scrap that normally would be directed out of the area is remaining here and dealers are enjoying an excellent demand.

Cleveland—Demand for all grades is good, with prices holding at ceiling. Dealers say blast furnace grades are hard to move. Cast scrap is still at ceiling but consumers are limiting springboards. Yard scrap is scarce.

St. Louis—Shipments of No. 2 heavy melting grades of scrap iron from the country have been very light, and the automobile wreckers have stopped dismantling cars pending resale of spare parts. Dealers' yards are almost depleted, but steel mills have good inventories into which they are eating. Cast iron grades are in the doldrums. Some are selling at ceiling prices or lower delivered.

Birmingham — Openhearth scrap continues to move north from this area, but not in so much volume as a couple of weeks ago. In some instances mills have made purchases, then ordered shipments held up until space is available. Dealers report supplies are becoming scarce and they do not expect much replenishment until the end of cotton picking, when farmers will again be bringing in scrap. Cast scrap is more plentiful, but not bountiful, and prices are unchanged.

Cincinnati — Cast prices here are weaker in face of slow demand. No. 1 cupola and stove plate are off $2. Electric furnace grades are in strong demand. Consumers and dealers say scrap is not coming in, and yard situation stays tight. Most mills have well-stocked inventories and are not interested in allocations.

Boston — Steelmaking grades continue to move steadily with all prices at ceiling. The cast market is still very weak, although some grades rose $1 from last week.

West Coast—Cast prices in the San Francisco area slipped to $43 last week, but in Los Angeles remained firm at $50. Some dealers in northern California shipped tonnage to Los Angeles. Market is expected to weaken soon, however. On steelmaking grades dealers are still reported pressuring for export licenses. Some mill buyers privately believe this is a move to boost the price back to ceiling. One major mill representative said he expects no return to ceiling in the West before the end of the year.

Iron and Steel SCRAP PRICES

(Maximum basing point prices, per gross ton, as set by OPS in CPR 5 and amendments.

GRADES	OPS No.	Pittsburgh, Johnstown, Brackenridge, Butler, Midland, Monessen, Sharon	Youngstown, Canton, Steubenville, Warren, Weirton	Cleveland, Buffalo, Cincinnati, Middletown	Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville	Sparrows Pt., Bethlehem, Ashland, Ky., Kokomo, Ind., Portsmouth, O.	St. Louis	Detroit	Duluth	Kansas City	Birmingham, Alabama City, Atlanta	Minnequa	Houston	Los Angeles, Pittsburg, Cal., Portland, Ore., San Francisco, Seattle
Switching Charge (Dollars per gross ton)		$0.99, .75, .83, .65, .75, .51, .75	.75, .51, .51, .75, .70	.78, .83, .65, .26	1.34, .79, .50, .20, .51, .51	.20, .52, .47, .51, .51	.51	.95	.50	.78	.50, .43, .51	.33	.57	.66, .65, .52, .66, .50
No. 1 bundles	1	$44.00	$44.00	$43.00	$42.50	$42.00	$41.00	$41.15	$40.00	$39.50	$39.00	$38.00	$37.00	$35.00
No. 1 busheling	2	44.00	44.00	43.00	42.50	42.00	41.00	41.15	40.00	39.50	39.00	38.00	37.00	35.00
No. 1 heavy melting	3	43.00	43.00	42.00	41.50	41.00	40.00	40.15	39.00	38.50	38.00	37.00	36.00	34.00
No. 2 heavy melting	4	43.00	43.00	42.00	41.50	41.00	40.00	40.15	39.00	38.50	38.00	37.00	36.00	34.00
No. 2 bundles	5	43.00	43.00	42.00	41.50	41.00	40.00	40.15	39.00	38.50	38.00	37.00	36.00	34.00
Machine shop turnings	6	34.00	34.00	33.00	32.50	32.00	31.00	31.15	30.00	29.50	29.00	28.00	27.00	25.00
Mixed borings and turnings	7	38.00	38.00	37.00	36.50	36.00	35.00	35.15	34.00	33.50	33.00	32.00	31.00	29.00
Shoveling turnings	8	38.00	38.00	37.00	36.50	36.00	35.00	35.15	34.00	33.50	33.00	32.00	31.00	29.00
Cast iron borings	10	38.00	38.00	37.00	36.50	36.00	35.00	35.15	34.00	33.50	33.00	32.00	31.00	29.00
No. 1 chemical borings	20	41.00	41.00	40.00	39.50	39.00	38.00	38.15	37.00	36.50	36.00	35.00	34.00	32.00
Forge crops	11	51.50	51.50	50.50	50.00	49.50	48.50	48.65	47.50	47.00	46.50	45.50	44.50	42.50
Bar crops and plate	12	49.00	49.00	48.00	47.50	47.00	46.00	46.15	45.00	44.50	44.00	43.00	42.00	40.00
Punchings and plate	14	46.50	46.50	45.50	45.00	44.50	43.50	43.65	42.50	42.00	41.50	40.50	39.50	37.50
Electric furnace bundles	15	46.00	46.00	45.00	44.50	44.00	43.00	43.15	42.00	41.50	41.00	40.00	39.00	37.00
Cut struc., plate, 3 ft and less	16	47.00	47.00	46.00	45.50	45.00	44.00	44.15	43.00	42.50	42.00	41.00	40.00	38.00
Cut struc., plate, 2 ft and less	17	49.00	49.00	48.00	47.50	47.00	46.00	46.15	45.00	44.50	44.00	43.00	42.00	40.00
Cut. struc., 1 ft and less	18	50.00	50.00	49.00	48.50	48.00	47.00	47.15	46.00	45.50	45.00	44.00	43.00	41.00
Foundry steel, 2 ft and less	20	44.00	44.00	43.00	42.50	42.00	41.00	41.15	40.00	39.50	39.00	38.00	37.00	35.00
Foundry steel, 1 ft and less	21	46.00	46.00	45.00	44.50	44.00	43.00	43.15	42.00	41.50	41.00	40.00	39.00	37.00
Heavy trimmings	24	43.00	43.00	42.00	41.50	41.00	40.00	40.15	39.00	38.50	38.00	37.00	36.00	34.00
No. 1 RR heavy melting	RR 1	46.00	46.00	45.00	44.50	44.00	43.00	43.15	42.00	41.50	41.00	40.00	39.00	37.00
Scrap rails, random lengths	RR 14	48.00	48.00	47.00	46.50	46.00	45.00	45.15	44.00	43.50	43.00	42.00	41.00	39.00
Scrap rails, 3 ft and less	RR 16	51.00	51.00	50.00	49.50	49.00	48.00	48.15	47.00	46.50	46.00	45.00	44.00	42.00
Scrap rails, 2 ft and less	RR 17	52.00	52.00	51.00	50.50	50.00	49.00	49.15	48.00	47.50	47.00	46.00	45.00	43.00
Scrap rails, 18 in. and less	RR 18	54.00	54.00	53.00	52.50	52.00	51.00	51.15	50.00	49.50	49.00	48.00	47.00	45.00
Rerolling rails	RR 15	53.00	53.00	52.00	51.50	51.00	50.00	50.15	49.00	48.50	48.00	47.00	46.00	44.00
Uncut tires	RR 20	48.00	48.00	47.00	46.50	46.00	45.00	45.15	44.00	43.50	43.00	42.00	41.00	39.00
Cut tires	RR 21	51.00	51.00	50.00	49.50	49.00	48.00	48.15	47.00	46.50	46.00	45.00	44.00	42.00
Cut bolsters and side frames	RR 23	49.00	49.00	48.00	47.50	47.00	46.00	46.15	45.00	44.50	44.00	43.00	42.00	40.00
RR specialties	RR 24, 28, 29	51.00	51.00	50.00	49.50	49.00	48.00	48.15	47.00	46.50	46.00	45.00	44.00	42.00
Solid steel axles	RR 25	58.00	58.00	57.00	56.50	56.00	55.00	55.15	54.00	53.50	53.00	52.00	51.00	49.00
No. 3 steel wheels	RR 27	51.00	51.00	50.00	49.50	49.00	48.00	48.15	47.00	46.50	46.00	45.00	44.00	42.00
Unassorted	RR 35	40.08	40.00	39.00	38.50	38.00	37.00	37.15	36.00	35.50	35.00	34.00	33.00	31.00

Cast Scrap Ceilings

Prices set by CPR 5, OPS

(F.o.b. all shipping points)

Grades	OPS No.	
Cupola cast	1	$49.00
Charging box cast	2	47.00
Heavy breakable cast	3	45.00
Cast iron brake shoes	5	41.00
Stove plate	6	46.00
Clean auto cast	7	52.00
Unstripped motor blocks	8	43.00
Cast iron carwheels	9	47.00
Malleable	10	55.00
Drop broken mach'y cast	11	52.00

Ceiling price of clean cast iron foundry ranout or prepared cupola drops is 75 pct of corresponding grade.

Under Ceiling Scrap Prices

Pittsburgh

Machine shop turnings	$32.00
Mixed borings, turnings	32.00
Cast iron borings	$35.00 to 35.50
No. 1 machinery cast	52.00
Heavy breakable cast	45.00
Malleable	55.00

Chicago

Low phos. forge crops	$50.00 to $51.00
Low phos. 3 ft and under	44.00 to 45.00
Cut struc., plate, 2 ft & less	45.00 to 46.00
Cut struc., plate, 3 ft & less	43.50 to 44.50
Machine shop turnings	30.00 to 31.50
Mixed borings, turnings	34.00 to 35.50
Shoveling turnings	34.00 to 35.50
Cast iron borings	34.00 to 35.50
Cupola cast	45.00 to 46.00
Heavy breakable cast	41.00 to 42.00
Malleable	53.00 to 55.00
Stove plate	42.00 to 43.00
Clean auto cast	48.00 to 50.00
Charging box cast	44.00 to 45.00
Drop broken mach'y	48.00 to 49.00
Unstripped motor blocks	36.00 to 38.00

Philadelphia Area

Clean cast chem. borings	$36.50 to $37.00
Cupola cast	47.00 to 48.00
Unstripped motor blocks	41.00 to 42.00
Charging box cast	45.00 to 46.00

Cleveland

Cast iron borings	$34.00 to $34.50
Stove plate	45.00 to 46.00
Malleable	54.00 to 55.00

Youngstown

Cast iron borings	$35.00 to $35.50

Buffalo

No. 1 machinery cast	$49.00 to $50.00
No. 1 cupola cast	46.00 to 47.00

Birmingham

Shoveling turnings	$30.00 to $32.00
Cast iron borings	30.00 to 32.00
No. 1 cupola cast	46.00 to 47.00
Stove plate	41.00 to 42.00
Charging box cast	39.00 to 40.00
Heavy breakable	37.00 to 38.00
Drop broken machinery	44.00 to 45.00
Unstripped motor blocks	37.00 to 38.00

New York

Brokers' Buying prices per gross ton, on cars:

Clean cast chem. borings	$30.00 to $30.50
No. 1 machinery cast	48.00 to 50.00
Mixed yard cast	43.00 to 44.00
Charging box cast	43.00 to 44.00
Heavy breakable cast	44.00 to 45.00
Unstripped motor blocks	36.00 to 37.00

Boston

Brokers' Buying prices per gross ton, on cars:

Machine shop turnings	$24.17
Short shoveling turnings	28.17
Mixed cupola cast	$40.00 to 41.00
Heavy breakable cast	39.00 to 40.00
Stove plate	38.00 to 39.00
Unstripped motor blocks	30.00 to 31.00

Detroit

Brokers' Buying prices per gross ton, on cars:

No. 1 cupola cast	$48.00
Heavy breakable cast	$43.00 to 44.00
Stove plate	43.00 to 44.00
Cast iron brake shoes	39.00 to 40.00

Cincinnati

No. 1 cupola cast	$49.00
Stove plate	46.00
Drop broken cast	$51.00 to $52.00

St. Louis

Charging box cast	$43.00 to $44.00
No. 1 cupola cast	43.00
Heavy breakable cast	41.00 to 42.00
Unstripped motor blocks	$38.00

San Francisco

No. 2 heavy melting	$31.00
No. 2 bundles	29.00
Machine shop turnings	17.00
No. 1 cupola cast	43.00

Los Angeles

No. 2 heavy melting	$31.00
No. 2 bundles	29.00
Machine shop turnings	17.00
Shoveling turnings	20.00
No. 1 cupola cast	50.00

Seattle

No. 2 bundles	$29.00
No. 1 cupola cast	40.50
Heavy breakable	35.50

Hamilton, Ont.

No. 1 hvy. melting	$35.50
No. 1 bundles	35.50
No. 2 bundles	35.00
Mechanical bundles	33.50
Mixed steel scrap	31.50
Mixed borings, turnings	32.50
Rails, remelting	35.50
Rails, rerolling	44.80
Bushelings	30.50
Bush, new fact. prep'd	33.50
Bush, new fact. unprep'd	32.50
Short steel turnings	32.50
Cast scrap	50.00

Comparison of Prices

Steel prices on this page are the average of various f.o.b. quotations of major producing areas: Pittsburgh, Chicago, Gary, Cleveland, Youngstown.

Price advances over previous week are printed in Heavy Type; declines appear in *Italics*.

	Oct. 7 1952	Sept. 30 1952	Sept. 9 1952	Oct. 9 1951
Flat-Rolled Steel: (per pound)				
Hot-rolled sheets	3.775¢	3.775¢	3.775¢	3.60¢
Cold-rolled sheets	4.575	4.575	4.575	4.35
Galvanized sheets (10 ga)	5.075	5.075	5.075	4.80
Hot-rolled strip	3.725	3.725	3.725	3.50
Cold-rolled strip	5.20	5.20	5.20	4.75
Plate	3.90	3.90	3.90	3.70
Plates wrought iron	9.00	9.00	9.00	7.85
Strains C-R strip (No. 302)	36.75†	36.75†	36.75†	36.75
Tin and Terneplate: (per base box)				
Tinplate (1.50 lb.) cokes	$8.95	$8.95	$8.95	$8.70
Tinplate, electro (0.50 lb.)	7.65	7.65	7.65	7.40
Special coated mfg. ternes	7.75	7.75	7.75	7.50
Bars and shapes: (per pound)				
Merchant bars	3.95¢	3.95¢	3.95¢	3.70¢
Cold finished bars	4.925	4.925	4.925	4.55
Alloy bars	4.675	4.675	4.675	4.30
Structural shapes	3.85	3.85	3.85	3.65
Stainless bars (No. 302)	31.50†	31.50†	31.50†	31.50
Wrought iron bars	10.05	10.05	10.05	9.50
Wire: (per pound)				
Bright wire	5.225¢	5.225¢	5.225¢	4.85¢
Rails: (per 100 lb)				
Heavy rails	$3.775	$3.775	$3.775	$3.60
Light rails	4.25	4.25	4.25	4.00
Semifinished Steel: (per net ton)				
Rerolling billets	$59.00	$59.00	$59.00	$56.00
Slabs rerolling	59.00	59.00	59.00	56.00
Forging billets	70.50	70.50	70.50	66.00
Alloy blooms, billets, slabs	76.00	76.00	76.00	70.00
Wire Rod and Skelp: (per pound)				
Wire rods	4.325¢	4.325¢	4.325¢	4.10¢
Skelp	3.55	3.55	3.55	3.35

† Add 4.7 pct.

	Oct. 7 1952	Sept. 30 1952	Sept. 9 1952	Oct. 9 1951
Composite: (per pound)				
Finished steel base price	4.376¢	4.376¢	4.376¢	4.131¢

	Oct. 7 1952	Sept. 30 1952	Sept. 9 1952	Oct. 9 1951
Pig Iron: (per gross ton)				
Foundry, del'd Phila.	$60.69	$60.69	$60.69	$57.97
Foundry, Valley	55.00	55.00	55.00	52.50
Foundry, Southern, Cin'ti	58.93	58.93	58.93	55.58
Foundry, Birmingham	51.38	51.38	51.38	48.88
Foundry, Chicago†	55.00	55.00	55.00	52.50
Basic del'd Philadelphia	59.77	59.77	59.77	57.09
Basic, Valley furnace	54.50	54.50	54.50	52.00
Malleable, Chicago†	55.00	55.00	55.00	52.50
Malleable, Valley	55.00	55.00	55.00	52.50
Charcoal, Chicago	78.34	78.34	78.34	70.56
Ferromanganese	226.25	226.25	226.25	186.25

† The switching charges for delivery to foundries in the Chicago district is $1 per ton.
‡ Average of U. S. prices quoted on Ferroalloy pages.

	Oct. 7 1952	Sept. 30 1952	Sept. 9 1952	Oct. 9 1951
Composite: (per gross ton)				
Pig iron	$55.26	$55.26	$55.26	$52.72
Scrap: (per gross ton)				
No. 1 steel, Pittsburgh	$43.00*	$43.00*	$43.00*	$44.00*
No. 1 steel, Phila. area	41.50*	41.50*	41.50*	42.50*
No. 1 steel, Chicago	41.50*	41.50*	41.50*	42.50*
No. 1 bundles, Detroit	41.15*	41.15*	41.15*	41.15*
Low phos., Youngstown	46.50*	46.50*	46.50*	46.50*
No. 1 cast, Pittsburgh	49.00†	49.00†	49.00†	49.00†
No. 1 cast, Philadelphia	47.50	47.50	48.50	49.00†
No. 1 cast, Chicago	45.50	45.50	45.50	49.00†

* Basing pt., less broker's fee. † Shipping pt., less broker's fee.

	Oct. 7 1952	Sept. 30 1952	Sept. 9 1952	Oct. 9 1951
Composite: (per gross ton)				
No. 1 heavy melting scrap	$42.00	$42.00	$42.00	$43.00
Coke, Connellsville: (per net ton at oven)				
Furnace coke, prompt	$14.75	$14.75	$14.75	$14.75
Foundry coke, prompt	17.75	17.75	17.75	17.75
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electrolytic, Conn.	24.50	24.50	24.50	24.50
Copper, Lake, Conn.	24.625	24.625	24.625	24.625
Tin, Straits, New York	$1.21⅜	$1.21⅜	$1.21⅜	$1.03
Zinc, East St. Louis	13.75	13.75	14.00	19.50
Lead, St. Louis	15.80	15.80	15.80	18.80
Aluminum, virgin ingot	20.00	20.00	20.00	19.00
Nickel, electrolytic	59.58	59.58	59.58	59.58
Magnesium, ingot	24.50	24.50	24.50	24.50
Antimony, Laredo, Tex.	39.00	39.00	39.00	42.00

Composite Price Notes

Finished Steel Composite

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strips, representing major portion of finished steel shipment. Index recapitulated in Aug. 28, 1941, issue and in May 12, 1949.

Starting with the issue of May 12, 1949, the weighted finished steel composite was revised for the years 1941 to date. The weights used are based on the average product shipments for the 7 years 1937 to 1940 inclusive and 1946 to 1948 inclusive. The use of quarterly figures has been eliminated because it was too sensitive. (See p. 139 of May 12, 1949, issue.)

Pig Iron Composite

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Scrap Steel Composite

Average of No. 1 heavy melting steel scrap delivered to consumers at Pittsburgh, Philadelphia and Chicago.

Warehouse Price Notes

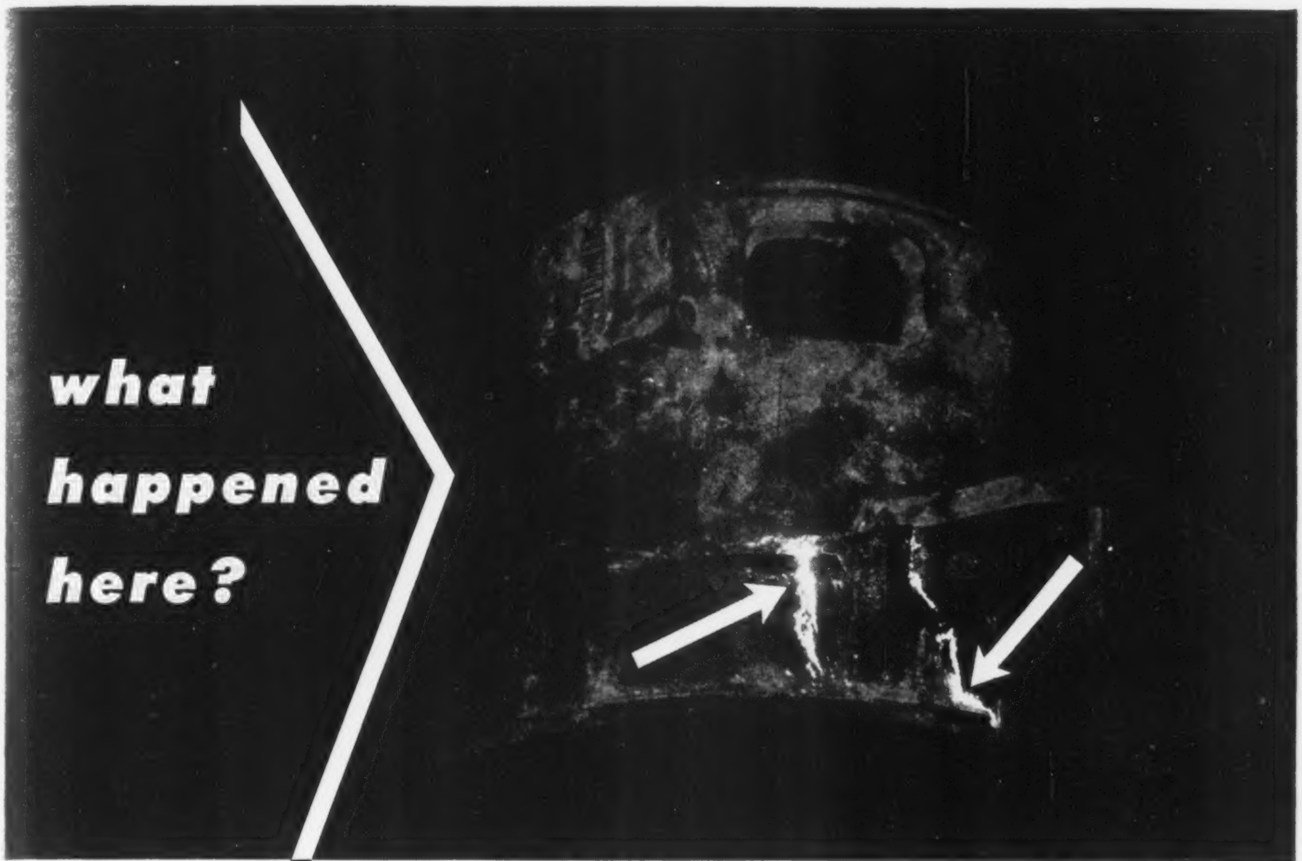
Base Quantities (Standard unless otherwise keyed): Cold finished bars; 2000 lb or over Alloy bars; 1000 to 1999 lb. All others; 2000 to 9999 lb. All HR products may be combined for quantity. All galvanized sheets may be combined for quantity. CR sheets may not be combined with each other or with galvanized sheets, for quantity.

Exceptions: (1)500 to 1499 lb, (2)1500 to 3499 lb, (3)6000 lb or over, (4)450 to 1499 lb.

WARE HOUSES

Base price, f.o.b., dollars per 100 lb.

Cities	City Delivery Charge	Sheets: Hot-Rolled	Sheets: Cold-Rolled (15 gage)	Sheets: Galvanized (10 gage)	Strip: Hot-Rolled	Strip: Cold-Rolled	Plates	Shapes: Standard Structural	Bars: Hot-Rolled	Bars: Cold-Finished	Alloy Bars: Hot-Rolled A 4615 As rolled	Alloy Bars: Hot-Rolled A 4140 Annealed	Alloy Bars: Cold-Drawn A 4615 As rolled	Alloy Bars: Cold-Drawn A 4140 Annealed
Baltimore	$.20	5.81	7.17	8.42- 8.57	6.42	......	6.30- 6.47	6.47	6.41	7.18- 7.43	......	......	......	......
Birmingham	.15	5.80	6.65	7.70[1]	5.80	......	6.10	5.95	5.80	8.25- 8.40	......	......	......	......
Boston	.20	6.48- 6.52	7.35- 7.52	8.59- 8.74	6.55	8.50[3]	6.75- 6.80	6.56- 6.75	6.38- 6.42	7.10- 7.54	10.78	11.15- 11.18	......	13.18
Buffalo	.20	5.76- 5.80	6.60- 6.65	8.40- 8.46	6.16- 6.21	6.19	6.26- 6.37	5.96- 6.08	5.76- 5.90	6.00- 6.95	10.70	11.00- 11.07	12.70	12.51- 14.42
Chicago	.20	5.80- 5.81	6.65	8.05	5.83- 5.84	......	5.95- 6.00	5.95	5.83	6.56- 6.92	......	10.65	......	12.65
Cincinnati	.15	6.13	6.72	8.52	6.21	......	6.47	6.42	6.13	7.16	......	11.07	......	13.07
Cleveland	.20	5.80- 5.81	6.65	8.16- 8.19	6.00- 6.01	......	6.12- 6.22	6.28- 6.33	5.89	6.66- 6.98	......	10.79	......	12.79
Denver	......	7.17	......	......	7.43- 7.69	8.90	7.37	7.50- 7.80	7.61- 7.71	8.24	......	......	......	......
Detroit	.20	6.00- 6.07	6.81- 6.92	8.34	6.13	7.99	6.45- 6.47	6.12- 6.45	6.12- 6.30	6.975- 7.21	10.72	10.92	12.72	13.02
Houston	.20	6.74- 6.79	7.78- 7.79	8.68	6.61- 6.75	9.80	6.63- 7.07	6.66- 6.79	6.82- 6.98	9.00- 9.62	11.90	11.90	......	13.90
Indianapolis	del'd.	......	......	......	......	......	......	......	......	......	......	......	......	......
Kansas City	.20	6.47	7.31	8.50- 8.72	6.51	8.07	6.62- 6.67	6.62	6.50	7.57	11.15- 11.90	11.45- 12.20	13.13- 13.88	13.43- 14.18
Los Angeles	.20	6.60	8.45- 8.49	9.80 10.55	6.74- 6.78	9.15	6.66- 6.71	6.60- 6.64	6.60- 6.62	8.36- 8.69	......	12.05	......	14.60
Memphis	.10	......	......	......	......	......	......	......	......	......	......	......	......	......
Milwaukee	.20	5.97- 5.98	6.82	8.02	6.00- 6.01	......	6.12- 6.17	6.12	6.00	6.83- 7.07	......	10.82	......	12.82
New Orleans	.15	6.28	7.12	......	6.32	......	6.43	6.43	6.31	7.85	......	......	......	......
New York	.30	6.26- 6.69	7.27- 7.60	8.31[2] 8.68	6.56- 7.05	9.53	6.60- 7.19	6.39- 6.70	6.59- 6.89	7.53- 8.05	10.74- 10.98	11.04- 11.28	12.74- 12.97	13.04- 13.27
Norfolk	.20	7.10	......	......	6.81	......	6.64	7.25	6.44	8.45	......	......	......	......
Philadelphia	.25	6.11- 6.38	7.13- 7.92	8.35- 8.79	6.45- 7.45	......	6.24- 6.86	6.17- 6.42	6.42- 6.68	7.45- 7.69	10.57	10.79- 11.02	......	12.79
Pittsburgh	.20	5.80- 5.81	6.65	8.05- 8.45	5.94- 5.97	......	5.95- 6.00	5.95	5.83	6.66- 6.90	......	10.65	......	12.65
Portland	.20	7.60 7.90	9.00 9.45	9.70	7.60 7.65	......	7.05	7.30	7.35	9.46	......	......	......	......
Salt Lake City	.20	8.30	......	10.90[4]	8.45	......	7.85	8.00	8.40		......	......	......	......
San Francisco	.15	6.80- 6.90	8.23	9.70- 10.05	6.79- 6.80	9.25- 9.70	7.10	6.79- 6.90	6.65- 6.70	8.40- 8.70	......	11.85	......	14.40
Seattle	.20	7.43	8.46	9.55	7.40	......	7.19	6.83	7.40	9.31	......	......	......	......
St. Louis	.20	6.10- 6.30	6.95- 7.83	8.35- 8.39	6.14-	9.73	6.35- 6.60	6.35	6.13- 6.33	6.96- 7.40	10.65	10.95	12.65	12.95
St. Paul	.15	6.47	7.31	8.71	6.50	......	6.61	6.61	6.49	7.32	......	......	......	......



. . . and why it saved plenty to find out

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IRON AGE

STEEL PRICES

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

		INGOTS		BILLETS, BLOOMS, SLABS			PIPE SKELP	PILING	SHAPES STRUCTURALS		STRIP			
		Carbon Forging Net Ton	Alloy Net Ton	Carbon Rerolling Net Ton	Carbon Forging Net Ton	Alloy Net Ton		Sheet Steel	Carbon	Hi Str. Low Alloy	Hot-rolled	Cold-rolled	Hi Str. H.R. Low Alloy	Hi Str. C.R. Low Alloy
EAST	Bethlehem, Pa.					$76.00 *B3*			3.90 *B3*	5.80 *B3*				
	Buffalo, N. Y.			$59.00 *B3*	$70.50 *B3, R3*	$76.00 *B3, R3*		4.675 *B3*	3.90 *B3*	5.80 *B3*	3.725 *B3, R3*	5.10 *B3*	5.70 *B3*	7.90 *B3*
	Claymont, Del.													
	Coatesville, Pa.													
	Conshohocken, Pa.				$77.50 *A2*	$83.00 *A2*					4.125 *A2*		5.90 *A2*	
	Harrisburg, Pa.													
	Hartford, Conn.													
	Johnstown, Pa.			$59.00 *B3*	$70.50 *B3*	$76.00 *B3*			3.90 *B3*	5.80 *B3*	3.725 *B3*			
	Newark, N. J.													
	New Haven, Conn.											5.60 *A5* 5.85 *D1*		
	Phoenixville, Pa.								6.10 *P2*					
	Putnam, Conn.													
	Sparrows Pt., Md.										3.725 *B3*	5.10 *B3*	5.70 *B3*	7.90 *B3*
	Worcester, Mass.													
	Trenton, N. J.											6.45 *R4*		
MIDDLE WEST	Alton, Ill.										4.20 *L1*			
	Ashland, Ky.										3.725 *A7*			
	Canton-Massillon, Ohio				$70.50 *R3*	$76.00 *R3* $78.60 *T5*								
	Chicago, Sterling, Ill.			$59.00 *U1*	$70.50 *U1, R3,W8*	$76.00 *U1, R3,W8*		4.675 *U1*	3.85 *U1, W8*	5.80 *U1*	3.725 *A1,W8* 4.725 *N4*	5.35 *A1*		
	Cleveland, Ohio				$70.50 *R3*							5.10 *A5,J3*		7.45 *J3*
	Detroit, Mich.	$56.00 *R5*	$57.00 *R5*		$73.50 *R5*	$79.00 *R5*					4.025 *G3* 4.40 *M2*	5.30 *G3* 5.45 *M2* 5.60 *D1* 6.05 *D2*	6.30 *G3*	8.15 *G3*
	Duluth, Minn.													
	Gary, Ind. Harbor, Indiana			$59.00 *U1*	$70.50 *U1*	$76.00 *U1, Y1*		4.675 *I3*	3.85 *I3, U1*	5.80 *I3, U1* 6.30 *Y1*	3.725 *I3, U1, Y1*	5.35 *I3*	5.65 *I3, U1* 6.15 *Y1*	
	Granite City, Ill.													
	Kokomo, Ind.													
	Middletown, Ohio											5.10 *A7*		
	Niles, Ohio Sharon, Pa.										4.225 *S1*	5.80 *S1*	5.65 *S1*	7.30 *S1*
	Pittsburgh, Pa.	$54.00 *U1*	$57.00 *U1*	$59.00 *U1, J3*	$70.50 *U1, J3*	$76.00 *U1*	3.55 *U1* 3.65 *J3*	4.675 *U1*	3.85 *U1,J3*	5.80 *U1,J3*	3.725 *J3,A7* 3.975 *A3* 4.225 *S7,S9*	5.10 *J3,A7* 5.45 *A3* 5.80 *B4,S7*		
	Portsmouth, Ohio													
	Weirton, Wheeling, Follansbee, W. Va.								4.10 *W3*		3.825 *W3*	5.10 *W3*	6.10 *W3*	7.95 *W3*
	Youngstown, Ohio					$76.00 *Y1, C10*	3.55 *U1, R3*			6.30 *Y1*	3.725 *U1, Y1,R3*	5.10 *R3, Y1* 5.70 *C5* 5.80 *B4*	5.65 *R3, U1* 6.15 *Y1*	7.30 *R3* 7.80 *Y1*
WEST	Fontana, Cal.	$81.00 *K1*	$83.00 *K1*	$78.00 *K1*	$89.50 *K1*	$95.00 *K1*			4.45 *K1*	6.40 *K1*	4.975 *K1*	6.75 *K1*	6.55 *K1*	
	Geneva, Utah				$70.50 *C7*				3.85 *C7*	5.80 *C7*				
	Kansas City, Mo.								4.45 *S2*		4.325 *S2*			
	Los Angeles, Torrance, Cal.				$89.50 *B2*	$96.00 *B2*			4.45 *C7,B2*	6.35 *B2*	4.475 *C7,B2*	6.85 *C1*	6.40 *B2*	
	Minnequa, Colo.								4.30 *C6*		4.775 *C6*			
	San Francisco, Niles, Pittsburg, Cal.				$89.50 *B2*				4.40 *B2* 4.56 *P9*	6.30 *B2*	4.475 *C7,B2*		6.40 *B2*	
	Seattle, Wash.				$89.50 *B2*				4.50 *B2*	6.40 *B2*	4.725 *B2*		6.65 *B2*	
SOUTH	Atlanta, Ga.										4.275 *A8*			
	Birmingham, Ala. Alabama City, Ala.			$59.00 *T2*	$70.50 *T2*				3.85 *T2,R3*	5.80 *T2*	3.725 *T2,R3*			
	Houston, Texas		$65.00 *S2*		$78.50 *S2*	$84.00 *S2*			4.25 *S2*		4.125 *S2*			

STEEL PRICES

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

SHEETS: Hot-rolled 18 ga. & hvyr.	SHEETS: Cold-rolled	SHEETS: Galvanized 10 ga.	SHEETS: Enameling 12 ga.	SHEETS: Long Terne 10 ga.	SHEETS: Hi Str. Low Alloy H.R.	SHEETS: Hi Str. Low Alloy C.R.	SHEETS: Hi Str. Low Alloy Galv.	SHEETS: Hot-rolled 19 ga.	WIRE ROD	TINPLATE†: Cokes* 1.25-lb. base box	TINPLATE†: Electro* 0.25-lb. base box	BLACK PLATE: Hollowware Enameling 29 ga.	
													Bethlehem, Pa.
3.775 *B3*	4.575 *B3*				5.675 *B3*	6.925 *B3*							Buffalo, N. Y.
													Claymont, Del.
													Coatesville, Pa.
4.175 *A2*					5.925 *A2*								Conshohocken, Pa.
													Harrisburg, Pa.
													Hartford, Conn.
									4.325 *B3*				Johnstown, Pa.
													Newark, N. J.
													New Haven, Conn.
													Phoenixville, Pa.
													Putnam, Conn.
3.775 *B3*	4.575 *B3*	5.075 *B3*			5.675 *B3*	6.925 *B3*	7.775 *B3*		4.425 *B3*	$8.80 *B3*	$7.50 *B3*		Sparrows Pt., Md.
									4.625 *A5*				Worcester, Mass.
									4.425 *R4*				Trenton, N. J.
									4.70 *L1*				Alton, Ill.
3.775 *A7*		5.075 *A7*	4.925 *A7*										Ashland, Ky.
		5.075 *R3*											Canton-Massillon, Ohio
3.775 *W8*					5.675 *U1*				4.325 *A5, N4, R3*				Chicago, Sterling, Ill.
3.775 *R3, J3*	4.575 *R3, J3*		4.925 *R3*		5.675 *R3, J3*	6.925 *R3, J3*			4.325 *A5*				Cleveland, Ohio
3.975 *G3*	4.775 *G3*				6.225 *G3*	7.475 *G3*							Detroit, Mich.
													Duluth, Minn.
3.775 *I3, U1, Y1*	4.575 *I3, U1, Y1*	5.075 *I3, U1*	4.925 *U1*	5.475 *U1*	5.675 *I3, U1* 6.175 *Y1*	6.925 *I3, U1* 7.425 *Y1*			4.325 *Y1*	$8.70 *U1, I3, Y1*	$7.40 *U1, I3*	6.10 *U1, Y1*	Gary Ind. Harbor, Indiana
4.30 *G2*	5.275 *G2*	5.50 *G2*	5.625 *G2*								$7.60 *G2*	6.30 *G2*	Granite City, Ill.
		5.475 *C9*											Kokomo, Ind.
	4.575 *A7*		4.925 *A7*	5.475 *A7*									Middletown, Ohio
4.175 *S1*					5.675 *S1*						$7.40 *R3*		Niles, Ohio Sharon, Pa.
3.775 *U1, J3, A7* 3.925 *A3*	4.575 *U1, J3, A7*	5.075 *U1*	4.925 *U1*		5.675 *U1, J3*	6.925 *U1, J3*	7.625 *U1*		4.325 *A5*	$8.70 *U1, J3*	$7.40 *U1, J3*	6.10 *U1*	Pittsburgh, Pa.
									4.525 *P7*				Portsmouth, Ohio
3.775 *W3, W5*	4.575 *W3, W5*	5.075 *W3, W5*		5.475 *W3, W5*	6.025 *W3*	7.275 *W3*				$8.70 *W3, W5*	$7.40 *W3, W5*	6.35 *W5*	Weirton Wheeling, Follansbee, W. Va.
3.775 *U1, R3, Y1*	4.575 *R3, Y1*	5.775 *R1*	4.925 *Y1*	6.05 *E2*	5.675 *R3, U1* 6.175 *Y1*	6.925 *R3* 7.425 *Y1*		5.65 *E2* 5.825 *R1*	4.325 *Y1*	$8.70 *R3*			Youngstown, Ohio
4.725 *K1*	5.525 *K1*				6.625 *K1*	7.875 *K1*			5.125 *K1*				Fontana, Cal.
3.875 *C7*													Geneva, Utah
													Kansas City, Mo.
4.475 *C7*		5.825 *C7*						5.575 *C7*	5.125 *C7, B2*				Los Angeles, Torrance, Cal.
									4.575 *C6*				Minnequa, Colo.
4.475 *C7*	5.525 *C7*	5.825 *C7*							4.975 *C7*	$9.45 *C7*	$8.15 *C7*		San Francisco, Niles, Pittsburg, Cal.
													Seattle, Wash.
													Atlanta, Ga.
3.775 *T2, R3*	4.575 *T2*	5.075 *T2, R3*			5.675 *T2*			4.925 *R3*	4.325 *T2, R3*	$8.80 *T2*	$7.50 *T2*		Birmingham, Ala. Alabama City, Ala.
									4.725 *S2*				Houston, Tex.

† Special coated mfg ternes deduct 95¢ from 1.25-lb coke base box price. Can-making quality blackplate 55 to 128 lb deduct $2.20 from 1.25-lb coke base box.
* COKES: 1.50-lb add 25¢.
ELECTRO: 0.50-lb add 25¢; 0.75-lb add 65¢.

IRON AGE

STEEL PRICES

Italics identify producers listed in key at end of table. Base prices, f.o.b. mill, in cents per lb., unless otherwise noted. Extras apply.

Region	City	BARS: Carbon Steel	BARS: Reinforcing	BARS: Cold Finished	BARS: Alloy Hot-rolled	BARS: Alloy Cold Drawn	BARS: Hi Str. H.R. Low Alloy	PLATES: Carbon Steel	PLATES: Floor Plate	PLATES: Alloy	PLATES: Hi Str. Low Alloy	WIRE: Mfgr's Bright
EAST	Bethlehem Pa.				4.675 B3	6.00 B3	5.925 B3					
EAST	Buffalo N. Y.	3.95 B3,R3	3.95 B3,R3	4.975 B5	4.675 B3,R3	6.00 B3,B5	5.925 B3	3.90 B3			5.95 B3	
EAST	Claymont Del.							4.35 C4		5.35 C4		
EAST	Coatesville Pa.							4.35 L4		5.75 L4		
EAST	Conshohocken Pa.							4.35 A2	4.95 A2		6.20 A2	
EAST	Harrisburg Pa.							6.50 C3	6.50 C3			
EAST	Hartford Conn.			5.475 R3		6.45 R3						
EAST	Johnstown Pa.	3.95 B3	3.95 B3		4.675 B3		5.925 B3	3.90 B3		5.25 B3	5.95 B3	5.225 B3
EAST	Newark N. J.			5.375 W10		6.35 W10						
EAST	New Haven Conn.											
EAST	Phoenixville Pa.											
EAST	Putnam Conn.			5.475 W10								
EAST	Sparrows Pt. Md.		3.95 B3					3.90 B3		5.25 B3	5.95 B3	5.325 B3
EAST	Worcester Mass.					6.35 A5						5.525 A5
EAST	Trenton N. J.											
MIDDLE WEST	Alton Ill.	4.50 L1										5.45 L1
MIDDLE WEST	Ashland Ky.							3.90 A7				
MIDDLE WEST	Canton-Massillon	3.95 R3		4.925 R2,R3	4.675 R3 4.72 T5	5.99 T5 6.00 R2,R3						
MIDDLE WEST	Chicago Sterling Ill.	3.95 U,W8, R3, 4.55 N4	3.95 R3 4.70 N4	4.925 A5,B5, W8,W10	4.675 R3 U1, W8	6.00 B5,L2, R3,W8,W10 6.05 A5		3.90 U1, W8	4.95 U1	5.25 U1	5.95 U1	5.225 A3, N4,R3 5.325 K2 5.475 W7
MIDDLE WEST	Cleveland Ohio	3.95 R3	3.95 R3	4.925 A5,C13		6.00 C13 6.05 A5	5.925 R3	3.90 R3,J3	4.95 J3		5.95 R3,J3	5.225 A5, C13,R3
MIDDLE WEST	Detroit Mich.	4.10 R5 4.30 G3		5.075 R5,P8 5.175 P3	4.825 R5 5.025 G3	6.15 R5,P8 6.20 P3	6.675 G3	4.45 G3			6.90 G3	
MIDDLE WEST	Duluth Minn.											5.252 A5
MIDDLE WEST	Gary Ind. Harbor Indiana	3.95 I3, U1, Y1	3.95 I3, U1, Y1	4.925 L2, M5,R3	4.675 I3, U1, Y1	6.90 L2,M5, R3,R5	5.925 I3, U1, 6.425 Y1	3.90 I3, U1, Y1	4.95 I3	5.25 U1	5.95 I3, U1 6.45 Y1	5.325 M4
MIDDLE WEST	Granite City Ill.							4.60 G2				
MIDDLE WEST	Kokomo Ind.											5.325 C9
MIDDLE WEST	Middletown Ohio											
MIDDLE WEST	Niles Ohio Sharon Pa.							4.15 S1		5.70 S1	5.95 S1	
MIDDLE WEST	Pittsburgh Pa.	3.95 U1,J3	3.95 U1,J3	4.925 A5,J3, W10,R3,C8	4.675 U1,J3	6.00 W10,C8 6.05 A5	5.925 U1,J3	3.90 U1,J3	4.95 U1,J3	5.25 U1,J3	5.95 U1,J3	5.225 A5, J3
MIDDLE WEST	Portsmouth Ohio											5.625 P7
MIDDLE WEST	Weirton Wheeling Follansbee W. Va.	4.10 W3						3.90 W5 4.20 W3				
MIDDLE WEST	Youngstown Ohio	3.95 U1, Y1, R3	3.95 U1, Y1, R3	4.925 Y1	4.675 U1,C10, Y1	6.00 C10, Y1	5.925 U1 6.425 Y1	3.90 U1, Y1, R3			5.95 R3 6.45 Y1	5.225 Y1
WEST	Fontana Cal.	4.65 K1	4.65 K1		5.725 K1		6.975 K1	4.50 K1		6.20 K1	6.55 K1	
WEST	Geneva Utah							3.90 C7			5.95 C7	
WEST	Kansas City Mo.	4.55 S2	4.55 S2		5.275 S2							5.825 S1
WEST	Los Angeles Torrance Cal.	4.65 C7,B2	4.65 C7,B2	6.375 R3	5.725 B2		6.625 B2					6.175 C7,B1
WEST	Minnequa Colo.	4.40 C6	4.75 C6					4.70 C6				5.475 C6
WEST	San Francisco Niles Pittsburg Cal.	4.65 C7,P9 4.70 B2	4.65 C7,P9 4.70 B2				6.675 B2					6.175 C6,C7
WEST	Seattle Wash.	4.70 B2	4.70 B2				6.675 B2	4.80 B2			6.85 B2	
SOUTH	Atlanta Ga.	4.50 A8	4.50 A8									5.475 A8
SOUTH	Birmingham Ala. Alamama City Ala.	3.95 T2,R3	3.95 T2,R3				5.925 T2	3.90 T2,R3			5.95 T2	5.225 T2, R3
SOUTH	Houston Tex.	4.35 S2	4.35 S2		5.075 S2			4.30 S2				5.625 S2

Turn Page

Key to Steel Producers

With Principal Offices

A1 Acme Steel Co., Chicago
A2 Alan Wood Steel Co., Conshohocken, Pa.
A3 Allegheny Ludlum Steel Corp., Pittsburgh
A4 American Cladmetals Co., Carnegie, Pa.
A5 American Steel & Wire Div., Cleveland
A6 Angell Nail & Chaplet Co., Cleveland
A7 Armco Steel Corp., Middletown, O.
A8 Atlantic Steel Co., Atlanta, Ga.

B1 Babcock & Wilcox Tube Co., Beaver Falls, Pa.
B2 Bethlehem Pacific Coast Steel Corp., San Francisco
B3 Bethlehem Steel Co., Bethlehem, Pa.
B4 Blair Strip Steel Co., New Castle, Pa.
B5 Bliss & Laughlin Inc., Harvey, Ill.

C1 Calstrip Steel Corp., Los Angeles
C2 Carpenter Steel Co., Reading, Pa.
C3 Central Iron & Steel Co., Harrisburg, Pa.
C4 Claymont Products Dept., Claymont, Del.
C5 Cold Metal Products Co., Youngstown
C6 Colorado Fuel & Iron Corp., Denver
C7 Columbia-Geneva Steel Div., San Francisco
C8 Columbia Steel & Shafting Co., Pittsburgh
C9 Continental Steel Corp., Kokomo, Ind.
C10 Copperweld Steel Co., Glassport, Pa.
C11 Crucible Steel Co. of America, New York
C12 Cumberland Steel Co., Cumberland, Md.
C13 Cuyahoga Steel & Wire Co., Cleveland

D1 Detroit Steel Corp., Detroit
D2 Detroit Tube & Steel Div., Detroit
D3 Driver Harris Co., Harrison, N. J.

E1 Eastern Stainless Steel Corp., Baltimore
E2 Empire Steel Co., Mansfield, O.

F1 Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
F2 Fitzsimmons Steel Corp., Youngstown
F3 Follansbee Steel Corp., Follansbee, W. Va.

G1 Globe Iron Co., Jackson, O.
G2 Granite City Steel Co., Granite City, Ill.
G3 Great Lakes Steel Corp., Detroit

H1 Hanna Furnace Corp., Detroit

I2 Ingersoll Steel Div., Chicago
I3 Inland Steel Co., Chicago
I4 Interlake Iron Corp., Cleveland

J1 Jackson Iron & Steel Co., Jackson, O.
J2 Jessop Steel Corp., Washington, Pa.
J3 Jones & Laughlin Steel Corp., Pittsburgh
J4 Joslyn Mfg. & Supply Co., Chicago

K1 Kaiser Steel Corp., Fontana, Cal.
K2 Keystone Steel & Wire Co., Peoria
K3 Koppers Co., Granite City, Ill.

L1 Laclede Steel Co., St. Louis
L2 La Salle Steel Co., Chicago
L3 Lone Star Steel Co., Dallas
L4 Lukens Steel Co., Coatesville, Pa.

M1 Mahoning Valley Steel Co., Niles, O.
M2 McLouth Steel Corp., Detroit
M3 Mercer Tube & Mfg. Co., Sharon, Pa.
M4 Mid-States Steel & Wire Co., Crawfordsville, Ind.
M5 Monarch Steel Co., Inc., Hammond, Ind.
M6 Mystic Iron Works, Everett, Mass.

N1 National Supply Co., Pittsburgh
N2 National Tube Co., Pittsburgh
N3 Niles Rolling Mills Co., Niles, O.
N4 Northwestern Steel & Wire Co., Sterling, Ill.

O1 Oliver Iron & Steel Co., Pittsburgh

P1 Page Steel & Wire Div., Monessen, Pa.
P2 Phoenix Iron & Steel Co., Phoenixville, Pa.
P3 Pilgrim Drawn Steel Div., Plymouth, Mich.
P4 Pittsburgh Coke & Chemical Co., Pittsburgh
P5 Pittsburgh Screw & Bolt Co., Pittsburgh
P6 Pittsburgh Steel Co., Pittsburgh
P7 Portsmouth Div., Detroit Steel Corp., Detroit
P8 Plymouth Steel Co., Detroit
P9 Pacific States Steel Co., Niles, Cal.

R1 Reeves Steel & Mfg. Co., Dover, O.
R2 Reliance Div. Eaton Mfg. Co., Massillon, O.
R3 Republic Steel Corp., Cleveland
R4 Roebling Sons Co. (John A.), Trenton, N. J.
R5 Rotary Electric Steel Co., Detroit

S1 Sharon Steel Corp., Sharon, Pa.
S2 Sheffield Steel Corp., Kansas City
S3 Shenango Furnace Co., Pittsburgh
S4 Simonds Saw & Steel Co., Fitchburg, Mass.
S5 Sloss Sheffield Steel & Iron Co., Birmingham
S6 Standard Forging Corp., Chicago
S7 Stanley Works, New Britain, Conn.
S8 Superior Drawn Steel Co., Monaca, Pa.
S9 Superior Steel Corp., Carnegie, Pa.
S10 Sweet's Steel Co., Williamsport, Pa.
S11 Seidelhuber Steel Rolling Mills, Seattle

T1 Tonawanda Iron Div., N. Tonawanda, N. Y.
T2 Tennessee Coal & Iron Div., Birmingham
T3 Tennessee Products & Chem. Corp., Nashville
T4 Thomas Steel Co., Warren, O.
T5 Timken Steel & Tube Div., Canton, O.
T6 Tremont Nail Co., Wareham, Mass.

U1 United States Steel Co., Pittsburgh
U2 Universal-Cyclops Steel Corp., Bridgeville, Pa.

W1 Wallingford Steel Co., Wallingford, Conn.
W2 Washington Steel Corp., Washington, Pa.
W3 Weirton Steel Co., Weirton, W. Va.
W4 Wheatland Tube Co., Wheatland, Pa.
W5 Wheeling Steel Corp., Wheeling, W. Va.
W6 Wickwire Spencer Steel Div., Buffalo
W7 Wilson Steel & Wire Co., Chicago
W8 Wisconsin Steel Co., S. Chicago, Ill.
W9 Woodward Iron Co., Woodward, Ala.
W10 Wyckoff Steel Co., Pittsburgh

Y1 Youngstown Sheet & Tube Co., Youngstown

MERCHANT WIRE PRODUCTS

F o b Mill	Standard & Coated Nails	Woven Wire Fence 9-15½ ga.	Fence Posts	Single Loop Bale Ties	Twisted Barbless Wire	Gal. Barbed Wire	Merch. Wire Ann'ld	Merch. Wire Gal.
	Col	Col	Col	Col	Col	Col	¢/lb	¢/lb
Alabama City R3*†	118	135	...	132	...	144	6.075	6.325
Aliquippa Pa J3	127	141	...	...	...	148	6.075	6.525
Atlanta A8	130	140	...	135	...	149	6.325	6.675
Bartonville K2	127	138	140	132	147	147	6.075	6.45
Buffalo W6	...	...	...	...	...	...	...	...
Cleveland A6	...	...	...	...	...	...	...	...
Cleveland A5	...	...	...	...	...	...	6.075	6.225
Crawfrdsvl M4	130	140	...	134	...	149	6.175	6.55
Donora Pa A5*	118	133	...	132	...	142	6.075	6.225
Duluth A5*	118	133	...	132	...	142	6.075	6.225
Fairfield Ala T2*	118	133	...	132	...	142	6.075	6.225
Houston S2	135	147	...	...	...	156	6.475	6.925
Johnstn Pa B3	127	...	148	...	149	...	...	6.575
Joliet Ill A5*	118	133	...	132	...	142	6.075	6.225
Kokomo Ind C9	...	...	142	...	...	...	6.175	6.425
Los Angeles B2	...	...	...	...	...	...	7.025	...
Kansas City S2	139	...	...	144	...	160	6.675	7.125
Minnequa C6*	123	146	138	137	...	153	6.325	6.70
Monessen P6	...	...	...	...	...	...	...	...
Moline Ill R3	...	...	136	...	...	...	...	...
Pittsburg Cal C7*	137	156	...	156	162	162	7.025	7.125
Pittsburgh P6	127	138	...	...	147	147	6.075	6.45
Portsmouth P7	132	...	...	...	...	...	6.47	...
Rankin Pa A5*	118	133	...	...	...	142	6.075	6.225
So Chicago R3*†	118	135	140	132	...	144	6.075	6.325
S San Fran C6	...	...	...	156	...	167	7.025	7.40
Sparrows Pt B3	129	...	...	134	151	...	...	6.675
Sterling Ill N4	127	138	...	132	147	...	6.075	6.45
Struthers O Y1‡	...	...	...	...	...	...	6.075	6.475
Torrance Cal C7*	138	...	...	...	...	...	7.025	...
Worcester A5*	124	...	...	...	...	...	6.375	6.525
Williamsport Pa S10	...	...	...	...	...	...	...	...

Cut Nails carloads base $7.80 per 100 lb. (less 20¢ to jobbers) at Conshohocken Pa. (A2) Wheeling W. Va. (W5) $7.80.

* Add 45¢ per 100 lb. on Std. & Coated Nails.

† Zinc extra if not included on Galv. Merch Wire.

‡ Galv. Merch. Wire based on 15¢ Zinc.

STAINLESS STEELS

Base price, cents per lb, f.o.b. mill. Ads 4.7 pct

Product	301	302	303	304	316	321	347	410	416	430
Ingots, rerolling	14.25	15.25	16.75	16.25	24.75	20.00	21.75	12.75	14.75	13.00
Slabs, billets, rerolling	18.50	20.00	22.00	21.00	32.25	26.25	28.50	16.50	20.00	16.75
Forg. discs, die blocks, rings	34.00	34.25	36.75	35.75	53.00	40.25	44.75	28.00	28.50	28.50
Billets, forging	26.25	26.50	28.50	27.75	41.50	31.25	35.00	21.50	22.00	22.00
Bars, wires, structurals	31.25	31.50	34.00	33.00	49.25	37.00	41.50	25.75	26.25	26.25
Plates	33.00	33.25	35.25	35.25	52.00	40.75	45.25	27.00	27.50	27.50
Sheets	41.00	41.25	43.25	43.25	57.00	49.25	53.75	36.50	37.00	39.00
Strip, hot-rolled	26.50	28.25	32.50	30.25	48.75	37.00	41.25	23.50	30.25	24.00
Strip, cold-rolled	34.00	36.75	40.25	38.75	59.00	48.25	52.25	30.50	37.00	31.00

STAINLESS STEEL PRODUCING POINTS—*Sheets* Midland, Pa., *C11* Brackenridge, Pa., *A3* Butler, Pa., *A7* McKeesport, Pa., *U1* Washington, Pa., *W2* (type 316 add 4.5¢) *J2* Baltimore, *E1* Middletown, O., *A7* Massillon, O., *R3* Gary, *U1* Bridgeville, Pa., *U2* New Castle, Ind., *I2* Ft. Wayne, *J4* Lockport, N. Y., *R4*.

Strip. Midland, Pa., *C11* Cleveland, *A5* Carnegie, Pa., *S9* McKeesport, Pa., *F1* Reading, Pa., *C2* Washington, Pa., *W2* (type 316 add 4.5¢); W. Leechburg, Pa., *A3* Bridgeville, Pa., *U2* Detroit, *M2* Canton-Massillon, O., *R3* Middletown, O., *A7* Harrison, N. J., *D3* Youngstown, *C5* Lockport, N. Y., *S4* Sharon, Pa., *S1* (type 301 add ¼¢); Butler, Pa., *A7* Wallingford, Conn., *W1*.

Bars. Baltimore, *A7* Duquesne, Pa., *U1* Munhall, Pa., *U1* Reading, Pa., *C2* Titusville, Pa., *U2* Washington, Pa., *J2* McKeesport, Pa., *U1, F1* Bridgeville, Pa., *U2* Dunkirk, N. Y., *A3* Massillon, O., *R3* Chicago, *U1* Syracuse, N. Y., *C11* Watervliet, N. Y., *A3* Waukegan, *A5* Lockport, N. Y., *S4* Canton, O., *T5* Ft. Wayne, *J4*.

Wires. Waukegan, *A5* Massillon, O., *R3* McKeesport, Pa., *F1* Ft. Wayne, *J4* Harrison, N. J., *D3* Baltimore, *A7* Dunkirk, *A3* Monessen, *P1* Syracuse, *C11* Bridgeville, *U2*.

Structurals. Baltimore, *A7* Massillon, O., *R3* Chicago, Ill., *J4* Watervliet, N. Y., *A3* Syracuse, *C11*.

Plates. Brackenridge, Pa., *A3* (type 416 add ½¢); Butler, Pa., *A7* Chicago, *U1* Munhall, Pa., *U1* Midland, Pa., *C11* New Castle, Ind., *I2* Lockport, N. Y., *S4* Middletown, *A7* Washington, Pa., *J2* Cleveland, Massillon, *R3*.

Forged discs, die blocks, rings. Pittsburgh, *C11* Syracuse, *C11* Ferndale, Mich., *A3* Washington, Pa., *J2*.

Forging billets Midland, Pa., *C11* Baltimore, *A7* Washington, Pa., *J2* McKeesport, *F1* Massillon, Canton, O., *R3* Watervliet, *A3* Pittsburgh, Chicago, *U1*; Syracuse, *C11*.

ALLEGHENY LUDLUM—Slightly higher on Type 301; slightly lower on others in 300 series.

WASHINGTON STEEL—Slightly lower on 300 series except where noted.

PIPE AND TUBING

Base discounts f.o.b. mills. Base price about $200 per net ton.

	BUTTWELD														SEAMLESS					
	½ In.		¾ In.		1 In.		1¼ In.		1½ In.		2 In.		2½-3 In.		2 In.		2½-3 In.		3½-4 In.	
	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal.	Blk.	Gal
STANDARD T. & C.																				
Sparrows Pt. *B3*	30.5	8.25	33.5	12.25	35.5	15.75	36.5	16.25	37.0	17.25	37.5	17.75	38.0	18.25	.....	.....	.....	.....	.....	.....
Youngstown *R3*	32.5	10.25	35.5	14.25	38.0	17.75	39.4	18.25	39.0	19.25	39.5	19.75	40.0	20.25	.....	.....	.....	.....	.....	.....
Fontana *K1*	21.0	+1.25	24.0	2.75	26.5	6.25	27.0	6.75	27.5	7.75	28.0	8.25	28.5	8.75	.....	.....	.....	.....	.....	.....
Pittsburgh *J3*	32.5	10.25	35.5	13.25	38.0	15.75	38.5	16.75	39.0	17.25	39.5	17.75	40.0	18.75	24.0	2.25	27.0	5.75	29.0	7.75
Alton Ill. *L1*	31.5	9.25	34.5	13.25	37.0	16.75	37.5	17.25	38.0	18.25	38.5	18.75	39.0	19.25	.....	.....	.....	.....	.....	.....
Sharon *M3*	32.5	9.25	35.5	13.25	38.0	16.25	38.5	16.75	39.0	17.25	39.5	17.75	40.0	18.25	.....	.....	.....	.....	.....	.....
Pittsburgh *N1*	32.5	10.25	35.5	14.25	38.0	17.75	38.5	18.25	39.0	19.25	39.5	19.75	40.0	20.25	24.0	.....	27.0	.....	29.0	.....
Wheeling *W5*	32.5	10.25	35.5	14.25	38.0	17.75	38.5	18.25	39.0	19.25	39.5	19.75	40.0	20.25	.....	.....	.....	.....	.....	.....
Wheatland *W4*	32.5	10.25	35.5	13.25	38.0	15.75	38.5	16.75	39.0	17.25	39.5	17.75	40.0	18.75	.....	.....	.....	.....	.....	.....
Youngstown *Y1*	32.5	10.25	35.5	14.25	38.0	17.75	38.5	18.25	39.0	19.25	39.5	19.75	40.0	20.25	24.0	3.75	27.0	6.75	29.0	8.75
Indiana Harbor *Y1*	31.5	9.25	34.5	13.25	37.0	16.75	37.5	17.25	38.0	18.25	38.5	18.75	39.0	19.25	.....	.....	.....	.....	.....	.....
Lorain *N2*	32.5	15.25	35.5	14.25	38.0	17.75	38.5	18.25	39.0	19.25	39.5	19.75	40.0	20.25	24.0	3.75	27.0	6.75	29.0	8.75
E&TRA STRONG PLAIN ENDS																				
Sparrows Pt. *B3*	30.25	9.5	34.25	13.5	36.25	17.0	36.75	17.5	37.25	18.5	37.75	19.0	38.25	19.5	.....	.....	.....	.....	.....	.....
Youngstown *R3*	32.25	11.5	36.25	15.5	38.25	19.0	38.75	19.5	39.25	20.5	39.75	21.0	40.25	21.5	.....	.....	.....	.....	.....	.....
Fontana *K1*	20.75	.....	24.75	.....	26.75	.....	27.25	.....	27.75	.....	28.25	.....	28.75		.....	.....	.....	.....	.....	.....
Pittsburgh *J3*	32.25	10.0	36.25	14.0	38.25	16.0	38.75	17.0	39.25	17.5	39.75	18.0	40.25	19.0	23.75	2.0	27.75	6.5	31.25	10.0
Alton Ill. *L1*	29.25	8.5	33.25	12.5	35.25	16.0	35.75	16.5	36.25	17.5	36.75	18.0	37.25	18.5	.....	.....	.....	.....	.....	.....
Sharon *M3*	32.25	10.5	36.25	14.5	38.25	17.5	38.75	18.0	39.25	18.5	39.75	19.0	40.25	19.5	.....	.....	.....	.....	.....	.....
Pittsburgh *N1*	32.25	11.5	36.25	15.5	38.25	19.0	38.75	19.5	39.25	20.5	39.75	21.0	40.25	21.5	23.75	.....	27.75	.....	31.25	.....
Wheeling *W5*	32.25	11.5	36.25	15.5	38.25	19.0	38.75	19.5	39.25	20.5	39.75	21.0	40.25	21.5	.....	.....	.....	.....	.....	.....
Wheatland *W4*	32.25	10.0	36.25	14.0	38.25	16.0	38.75	17.0	39.25	17.5	39.75	18.0	40.25	19.0	.....	.....	.....	.....	.....	.....
Youngstown *Y1*	32.25	11.5	36.25	15.5	37.75	19.0	38.75	19.5	39.25	20.5	39.75	21.0	40.25	22.5	23.75	4.5	27.75	8.5	31.25	12.0
Indiana Harbor *Y1*	31.25	10.5	35.25	14.5	37.25	17.5	37.75	18.5	38.25	19.5	38.75	20.0	39.25	20.5	.....	.....	.....	.....	.....	.....
Lorain *N2*	32.25	11.5	36.25	15.5	38.25	19.0	38.75	19.5	39.25	20.5	39.75	21.0	40.25	21.5	23.75	4.5	27.75	8.5	31.25	12.0

Galvanized discounts based on zinc, at 17¢ per lb, East St. Louis. For each 1¢ change in zinc, discounts vary as follows: ½ in., ¾ in., and 1 in., 1 pt.; 1¼ in., 1½ in., 2 in., ¾ pt.; 2½ in., 3 in., ½ pt. Calculate discounts on even cents per lb of zinc, i.e., if zinc is 16.51¢ to 17.50¢ per lb, use 17¢. Jones & Laughlin discounts apply only when zinc price changes 1¢
Threads only buttweld and seamless, 1 pt. higher discount. Plain ends, buttweld and seamless, 3 in. and under 3½ pts. higher discount. Buttweld jobbers' discount, 5 pct. St. Louis zinc price now 13.5¢.

COKE

Furnace, beehive (f.o.b. oven)	Net-Ton
Connellsville, Pa.	$14.50 to $15.00
Foundry, beehive (f.o.b. oven)	
Connellsville, Pa.	$17.50 to $18.00
Foundry, oven coke	
Buffalo, del'd	$26.58
Chicago, f.o.b.	23.00
Detroit, f.o.b.	24.00
New England, del'd	24.80
Seaboard, N. J., f.o.b.	22.75
Philadelphia, f.o.b.	22.70
Swedeland, Pa., f.o.b.	22.60
Painesville, Ohio, f.o.b.	24.00
Erie, Pa., f.o.b.	23.50
Cleveland, del'd	25.72
Cincinnati, del'd	25.00
St. Paul, f.o.b.	22.50
St. Louis	25.40
Birmingham, del'd	21.69
Neville Island	23.00

ELECTRICAL SHEETS

22 Ga. H-R cut length F.o.b. Mill Cents Per Lb.	Armature	Elec.	Motor	Dynamo	Transf. 72	Transf. 65	Transf. 58
Beech Bottom *W5*	.....	7.85	9.10	9.90	10.45	11.00	11.70
Brackenridge *A3*	7.35	7.85	9.10	9.90	10.45	11.00	11.70
Granite City *G2*	.....	8.55	9.80	.....	.....	.....	.....
Ind. Harbor *I3*	7.35	7.85	9.10	.....	.....	.....	.....
Mansfield *E2*	7.35	7.85	9.10	9.90	.....	.....	.....
Niles, O. *N3*	7.35	7.85	.....	.....	.....	.....	.....
Vandergrift *U1*	7.35	7.85	9.10	9.90	10.45	11.00	11.70
Warren, O. *R3*	7.35	7.85	9.10	.....	.....	.....	.....
Zanesville *A7*	7.35	7.85	9.10	9.90	10.45	11.00	11.70

PIG IRON

Dollars per gross ton, f.o.b., subject to switching charges

Producing Point	Basic	Foundry	Malleable	Bessemer	Low Phos.	Bl. Furnace Silvery	Low Phos. Charcoal
Bethlehem *B3*	56.50	57.00	57.50	58.00	.....	.....	.....
Birmingham *R3*	50.88	51.38	.....	.....	.....	.....	.....
Birmingham *W9*	50.88	51.38	.....	.....	.....	.....	.....
Birmingham *S5*	50.88	51.38	.....	.....	.....	.....	.....
Buffalo *R3*	54.50	55.00	55.50	.....	.....	.....	.....
Buffalo *H1*	54.50	55.00	55.50	.....	.....	66.75	.....
Buffalo *W6*	54.50	55.00	55.50	.....	.....	.....	.....
Chicago *I4*	54.50	55.00	55.00	55.50	.....	.....	.....
Cleveland *A5*	54.50	55.00	55.00	55.50	59.50	.....	.....
Cleveland *R3*	54.50	55.00	55.00	.....	.....	.....	.....
Daingerfield, Tex. *L3*	50.50	51.00	51.00	.....	.....	.....	.....
Duluth *I4*	54.50	55.00	55.00	55.50	.....	.....	.....
Erie *I4*	54.50	55.00	55.00	55.50	.....	.....	.....
Everett, Mass *M6*	.....	59.25	59.75	.....	.....	.....	.....
Fontana *K1*	60.50	61.00	.....	.....	.....	.....	.....
Geneva, Utah *C7*	54.50	55.00	.....	.....	.....	.....	.....
Granite City, Ill. *K3*	56.40	56.90	57.40	.....	.....	.....	.....
Hubbard, Ohio *Y1*	54.50	55.00	55.00	.....	.....	.....	.....
Ironton, Utah *C7*	54.50	.....	.....	.....	.....	.....	.....
Jackson, Ohio *J1 G1*	.....	.....	.....	.....	.....	65.50	.....
Lyle, Tenn. *T3*	.....	.....	.....	.....	.....	.....	68.50
Minnequa *C6*	56.50	57.50	57.50	.....	.....	.....	.....
Monessen *P6*	56.50	.....	.....	.....	.....	.....	.....
Neville Island *P4*	54.50	55.00	55.00	55.50	.....	.....	.....
Pittsburgh *U1*	54.50	.....	.....	55.50	.....	.....	.....
Sharpsville *S3*	54.50	55.00	55.00	55.50	.....	.....	.....
Steelton *B3*	56.50	57.00	57.50	58.00	62.50	.....	.....
Swedeland *A2*	58.50	59.00	59.50	60.00	.....	.....	.....
Toledo *I4*	54.50	55.00	55.00	55.50	.....	.....	.....
Troy, N. Y. *R3*	56.50	57.00	57.50	.....	62.50	.....	.....
Youngstown *Y1*	54.50	55.00	55.00	55.50	.....	.....	.....
N. Tonawanda, N. Y. *T1*	.....	55.00	55.50	.....	.....	.....	.....

DIFFERENTIALS: Add 50¢ per ton for each 0.25 pct silicon over base, (1.75 to 2.25 pct, except low phos., 1.75 to 2.00 pct), 50¢ per ton for each 0.50 pct manganese over 1 pct, $2 per ton for 0.5 to 0.75 pct nickel, $1 for each additional 0.25 pct nickel. Subtract 38¢ per ton for phosphorus, content 0.70 pct and over. Silvery Iron: Add $1.50 per ton net for each 0.50 pct silicon over base (6.01 to 6.50 pct) up to 17 pct. $1 per ton for 0.75 pct or more phosphorus, manganese as above. Bessemer ferrosilicon prices are $1 over comparable silvery iron.

CAST IRON WATER PIPE

	Per Net Ton
6 to 24-in., del'd Chicago	$105.30 to $108.80
6 to 24-in., del'd N.Y.	108.50 to 109.50
6 to 24-in., Birmingham	91.50 to 96.00
6-in. and larger, f.o.b. cars, San Francisco, Los Angeles, for all rail shipments; rail and water shipments less	$123.00 to $130.00

Class "A" and gas pipe, $5 extra; 4-in. pipe is $5 a ton above 6-in.

BOILER TUBES

$ per 100 ft. carload lots, cut 10 to 24 ft. F.o.b. Mill	Size		Seamless		Elec. Weld	
	OD-In.	B.W. Ga.	H.R.	C.D.	H.R.	C.D.
Babcock & Wilcox	2	13	23.93	28.14	23.19	27.28
	2½	12	32.17	37.83	31.19	36.67
	3	12	35.78	42.11	34.69	40.82
	3½	11	44.72	52.65	43.36	51.05
	4	10	55.52	65.31	53.83	63.32
National Tube	2	13	22.81	27.94	22.23	.....
	2½	12	31.28	38.31	30.51	.....
	3	12	35.87	43.93	34.98	.....
	3½	11	42.56	52.12	.....	.....
	4	10	54.02	66.16	.....	.....
Pittsburgh Steel	2	13	...	28.58	.....	.....
	2½	12	32.16	39.19	.....	.....
	3	12	36.87	44.93	.....	.....
	3½	11	43.76	53.32	.....	.....
	4	10	55.54	67.68	.....	.....

C-R SPRING STEEL

Cents Per Lb. F.o.b. Mill	CARBON CONTENT				
	0.26-0.40	0.41-0.60	0.61-0.80	0.81-1.05	1.06-1.35
Bridgeport, Conn. *S7*	.....	.....	.....	.....	.....
Carnegie, Pa. *S9*	.....	7.65	8.25	10.20	12.50
Cleveland *A5*	5.10	7.30	8.25	10.20	12.[illegible]
Detroit *D1*	6.45	7.50	8810	.....	.....
New Castle, Pa. *B4*	5.80	7.65	8.25	10.20	.....
New Haven, Conn. *D1*	6.70	7.60	8.20	.....	.....
Sharon Pa. *S1*	5.80	7.65	8.25	10.20	12.[illegible]
Trenton N. J. *R4*	.....	7.95	8.55	10.50	12.[illegible]
Weirton W. Va. *W3*	5.80	7.65	8.25	10.20	12.[illegible]
Worcester, Mass. *A5*	5.40	7.60	8.55	10.50	12.[illegible]
Youngstown *C5*	.....	7.65	8.25	10.20	12.[illegible]

—Miscellaneous Prices—

RAILS, TRACK SUPPLIES

F.o.b. Mill Cents Per Lb	No. 1 Std. Rails	Light Rails	Joint Bars	Track Spikes	Screw Spikes	Tie Plates	Track Bolts Treated
Bessemer *U1*	3.775	4.25	4.925				
Chicago *R3*				6.65			
Cleveland *R3*							
Ensley *T2*	3.775	4.25					
Fairfield *T2*		4.25		6.65		4.775	
Gary *U1*	3.775	4.25				4.775	
Ind. Harbor *I3*	3.775		4.925	6.65		4.775	
Johnstown *B3*		4.25					
Joliet *U1*		4.25	4.925				
Kansas City *S2*							
Lackawanna *B3*	3.775	4.25	4.925			4.775	
Lebanon *B3*				6.65			
Minnequa *C6*	3.775	4.75	4.925	6.65		4.775	9.85
Pittsburgh *R3*							
Pittsburgh *O1*							
Pittsburgh *P5*							
Pittsburgh *J3*				6.65			
Pitt'g, Cal. *C7*						4.925	
Seattle *B2*				7.15		4.925	
Steelton *B3*	3.775		4.925			4.775	
Struthers *Y1*				6.65			
Torrance *C7*						4.925	
Youngstown *R3*				6.65			

TOOL STEEL

F.o.b. mill
Add 4.7 pct

W	Cr	V	Mo	Co	Base per lb
18	4	1	—	—	\$1.505
18	4	1	—	5	\$2.13
18	4	2	—	—	\$1.65
1.5	4	1.5	8	—	81.0¢
6	4	2	6	—	96.5¢

High-carbon chromium	63.5¢
Oil hardened manganese	35¢
Special carbon	32.5¢
Extra carbon	27¢
Regular carbon	23¢

Warehouse prices on and east of Mississippi are 3.5¢ per lb. higher. West of Mississippi, 5.5¢ higher.

CLAD STEEL

Add 4.7 pct

	Plate	Sheet
Stainless-carbon		
No. 304, 20 pct.		
Coatesville, Pa. *L4*	*29.5	
Washington, Pa. *J2*	*29.5	
Claymont, Del. *C4*	*28.00	
Conshohocken, Pa. *A2*		*27.50
New Castle, Ind. *I2*	*29.77	*26.24
Nickel-carbon		
10 pct Coatesville, Pa. *L4*	32.5	
Inconel-carbon		
10 pct Coatesville, Pa. *L4*	40.5	
Monel-carbon		
10 pct Coatesville, Pa. *L4*	33.5	
No. 302 Stainless-copper stainless, Carnegie, Pa. *A4*		77.00
Aluminized steel sheets, hot dip, Butler, Pa. *A7*		7.75

* Includes annealing and pickling, or sandblasting.

ELECTRODES

Cents per lb, f.o.b., plant threaded electrodes with nipples, unboxed

Diam. in in.	Length in in.	Cents Per lb.
	GRAPHITE	
17, 18, 20	60, 72	17.85
8 to 16	48, 60, 72	17.85
7	48, 60	19.57
6	48, 60	20.95
4, 5	40	21.50
3	40	22.61
2½	24, 30	23.15
2	24, 30	25.36
	CARBON	
40	100, 110	8.03
35	65, 110	8.03
30	65, 84, 110	8.03
24	72 to 104	8.03
20	84, 90	8.03
17	60, 72	8.03
14	60, 72	8.57
10, 12	60	8.84
8	60	9.10

FLUORSPAR

Washed gravel, f.o.b. Rosiclaire, Ill. Price, net ton; Effective CaF_2 content:

70% or more	\$43.00
60% or less	40.00

—Miscellaneous Prices—

BOLTS, NUTS, RIVETS, SCREWS

Consumer Prices

(Base, discount, f.o.b. mill, Pittsburgh, Cleveland, Birmingham or Chicago)

Nuts, Hot Pressed, Cold Punched—Sq.

Pct Off List

	Reg. Less Keg.	Reg. K.	Hvy. Less Keg.	Hvy. K.
½ in. & smaller	15	28½	15	28⅛
9/16 in. & ⅝ in.	12	25	6½	21
¾ in. to 1½ in inclusive	9	23	1	16⅛
1⅝ in. & larger	7½	22	1	16⅛

Nuts, Hot Pressed—Hexagon

½ in. & smaller	26	37	22	34
9/16 in. & ⅝ in.	16½	29½	6½	21
¾ in. to 1½ in. inclusive	12	25	2	17⅛
1⅝ in. & larger	8⅛	23	2	17⅛

Nuts, Cold Punched—Hexagon

½ in. & smaller	26	37	22	34
9/16 in. & ⅝ in.	23	35	17½	30⅛
¾ in. to 1½ in. inclusive	19½	31½	12	25
1⅝ in. & larger	8½	23	2	17⅛

Nuts, Semi-Finished—Hexagon

	Reg.		Hvy.	
½ in. & smaller	35	45	28½	29½
9/16 in. & ⅝ in.	23	35	17½	30½
¾ in. to 1½ in. inclusive	24	36	15	28½
1⅝ in. & larger	13	26	8½	23
	Light			
7/16 in. & smaller	35	45		
½ in. thru ⅝ in.	28½	39½		
¾ in. to 1½ in. inclusive	26	37		

Stove Bolts

	Pct Off List
Packaged, steel, plain finished	48—10
Packaged, plain finish	31—10
Bulk, plain finish**	62*

*Discounts apply to bulk shipments in not less than 15,000 pieces of a size and kind where length is 3-in. and shorter; 5000 pieces for lengths longer than 3-in. For lesser quantities, packaged price applies.

**Zinc, Parkerized, cadmium or nickel plated finishes add 6¢ per lb net. For black oil finish, add 2¢ per lb net.

Rivets

	Base per 100 lb
½ in. & larger	$7.85

Cap and Set Screws

(In bulk)	Pct Off List
Hexagon head cap screws, coarse or fine thread, ¼ in. thru ⅝ in. x 6 in., SAE 1020, bright	54
¾ in. thru 1 in. up to & including 6 in.	48
¼ in. thru ⅝ in. x 6 in. & shorter high C double heat treat	46
¾ in. thru 1 in. up to & including 6 in.	41
Milled studs	35
Flat head cap screws, listed sizes	16
Fillister head cap, listed sizes	34
Set screws, sq head, cup point, 1 in. diam. and smaller x 6 in. & shorter	53

Machine and Carriage Bolts

	Pct Off List Less Case	C
½ in & smaller x 6 in. & shorter	15	28½
9/16 in. & ⅝ in. x 6 in. & shorter	18½	30½
¾ in. & larger x 6 in. & shorter	17½	29½
All diam. longer than 6 in.	14	27½
Lag, all diam. x 6 in. & shorter	23	35
Lag, all diam. longer than 6 in.	21	33
Plow bolts	34	..

—Miscellaneous Prices—

REFRACTORIES

Fire Clay Brick *Carloads, per 1000*

First quality, Ill., Ky., Md., Mo., Ohio, Pa. (except Salina, Pa., add $5)	$94.60
No. 1 Ohio	88.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	88.00
No. 2 Ohio	79.20
Ground fire clay, net ton, bulk (except Salina, Pa., add $1.50)	13.75

Silica Brick

Mt. Union, Pa., Ensley, Ala.	$94.60
Childs, Pa.	99.00
Hays, Pa.	100.10
Chicago District	104.50
Western Utah and Calif.	111.10
Super Duty, Hays, Pa., Athens, Tex., Chicago	111.10
Silica cement, net ton, bulk, Eastern (except Hays, Pa.)	16.50
Silica cement, net ton, bulk, Hays, Pa.	18.70
Silica cement, net ton, bulk, Ensley, Ala.	17.60
Silica cement, net ton, bulk, Chicago District	17.60
Silica cement, net ton, bulk, Utah and Calif.	24.70

Chrome Brick *Per Net Ton*

Standard chemically bonded Balt., Chester	$82.00

Magnesite Brick

Standard, Baltimore	$104.00
Chemically bonded, Baltimore	93.00

Grain Magnesite *St. ⅝-in. grains*

Domestic, f.o.b. Baltimore in bulk fines removed	$62.70
Domestic, f.o.b. Chewalah, Wash., in bulk	36.30
in sacks	41.80

Dead Burned Dolomite

F.o.b. producing points in Pennsylvania, West Virginia and Ohio per net ton, bulk Midwest, add 10¢; Missouri Valley, add 20¢	$13.75

LAKE SUPERIOR ORES

51.50% Fe; natural content, delivered lower Lake ports. Prices effective July 26, 1952

	Gross Ton
Old range, bessemer	$9.45
Old range, nonbessemer	9.30
Mesabi, bessemer	9.20
Mesabi, nonbessemer	9.05
High phosphorus	9.05

After adjustments for analysis, prices will be increased or decreased as the case may be for increases or decreases after Dec. 1, 1950, in Lake vessel rates, upper Lake rail freights, dock handling charges and taxes thereon.

METAL POWDERS

Per pound, f.o.b. shipping point, in ton lots, for minus 100 mesh.

Swedish sponge iron c.i.f. New York, ocean bags	10.9¢
Canadian sponge iron, del'd, in East	12.0¢
Domestic sponge iron, 98+% Fe, carload lots	15.5¢ to 17.0¢
Electrolytic iron, annealed, 99.5+% Fe	44.0¢
Electrolytic iron, unannea ed, minus 325 mesh, 99+% Fe	60.0¢
Hydrogen reduced iron, minus 300 mesh, 98+% Fe	63.0¢ to 80.0¢
Carbonyl iron, size 5 to 10 micron, 98%, 99.8+% Fe	83.0¢ to $1.48
Aluminum	31.5¢
Brass, 10 ton lots	30.00¢ to 33.25¢
Copper, electrolytic	10.75¢ plus metal value
Copper, reduced	10.00¢ plus metal value
Cadmium, 100-199 lb.	95¢ plus metal value
Chromium, electrolytic, 99% min., and quantity, del'd	$3.50
Lead	7.5¢ to 12.0¢ plus metal value
Manganese	57.0¢
Molybdenum, 99%	$2.75
Nickel, unannealed	88.0¢
Nickel, annealed	95.0¢
Nickel, spherical, unannealed	92.0¢
Silicon	38.5¢
Solder powder	7.0¢ to 9.0¢ plus met. value
Stainless steel, 302	83.00¢
Stainless steel, 316	$1.10
Tin	14.00¢ plus metal value
Tungsten, 99% (65 mesh)	$6.00
Zinc, 10 ton lots	23.0¢ to 30.5¢

—Ferroalloy Prices—

Ferrochrome

Contract prices, cents per pound, contained Cr, lump size, bulk in carloads delivered. (65-72% Cr, 2% max. Si.)

0.06% C	30.50	0.20% C	29.50
0.10% C	30.00	0.50% C	29.25
0.15% C	29.75	1.00% C	29.00
2.00% C			28.75
65-69% Cr, 4-9% C			22.00
62-66% Cr, 4-6% C, 6-9% Si			22.60

S. M. Ferrochrome

Contract price, cents per pound, chromium contained, lump size, delivered.

High carbon type: 60-65% Cr, 4-6% Si, 4-6% Mn, 4-6% C.

Carloads	21.60
Ton lots	23.75
Less ton lots	25.25

Low carbon type: 62-66% Cr, 4-6% Si, 4-6% Mn, 1.25% max. C.

Carloads	27.75
Ton lots	30.05
Less ton lots	31.85

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 5¢ per lb to regular low carbon ferrochrome price schedule. Add 5¢ for each additional 0.25% N.

Chromium Metal

Contract prices, per lb chromium contained, packed, delivered, ton lots, 97% min. Cr, 1% max. Fe.

0.10% max. C	$1.14
0.50% max. C	1.10
9 to 11% C	1.08

Low Carbon Ferrochrome Silicon

(Cr 34-41%, Si 42-49%, C 0.05% max.) Contract price, carloads, f.o.b. Niagara Falls, freight allowed: lump 4-in. x down, bulk 2-in. x down, 21.75¢ per lb of contained Cr plus 12.40¢ per lb of contained Si.

Bulk 1-in. x down, 21.90¢ per lb contained Cr plus 12.60¢ per lb contained Si

Calcium-Silicon

Contract price per lb of alloy, dump delivered.

30-33% Ca, 60-65% Si, 3.00% max. Fe.

Carloads	19.00
Ton lots	22.10
Less ton lots	23.60

Calcium-Manganese—Silicon

Contract prices, cents per lb of alloy lump, delivered.

16-20% Ca, 14-18% Mn, 53-59% Si.

Carloads	20.00
Ton lots	22.30
Less ton lots	23.30

CMSZ

Contract price, cents per lb of alloy, delivered.

Alloy 4: 45-49% Cr, 4-6% Mn, 18-21% Si, 1.25-1.75% Zr, 3.00-4.5% C.

Alloy 5: 50.56% Cr, 4-6% Mn, 13.50-16.00% Si, 0.75 to 1.25% Zr, 3.50-5.00% C.

Ton lots	20.75
Less ton lots	22.00

SMZ

Contract price, cents per pound of alloy, delivered, 60-65% Si, 5-7% Mn, 5-7% Zr, 20% Fe, ½ in. x 12 mesh.

Ton lots	17.50
Less ton lots	19.50

V Foundry Alloy

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis. V-5: 38-42% Cr, 17-19% Si, 8-11% Mn.

Ton lots	16.50
Less ton lots	17.75

Graphidox No. 4

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis. Si 48 to 52%, Ti 9 to 11%, Ca 5 to 7%.

Carload packed	18.00
Ton lots to carload packed	19.00
Less ton lots	20.50

Ferromanganese

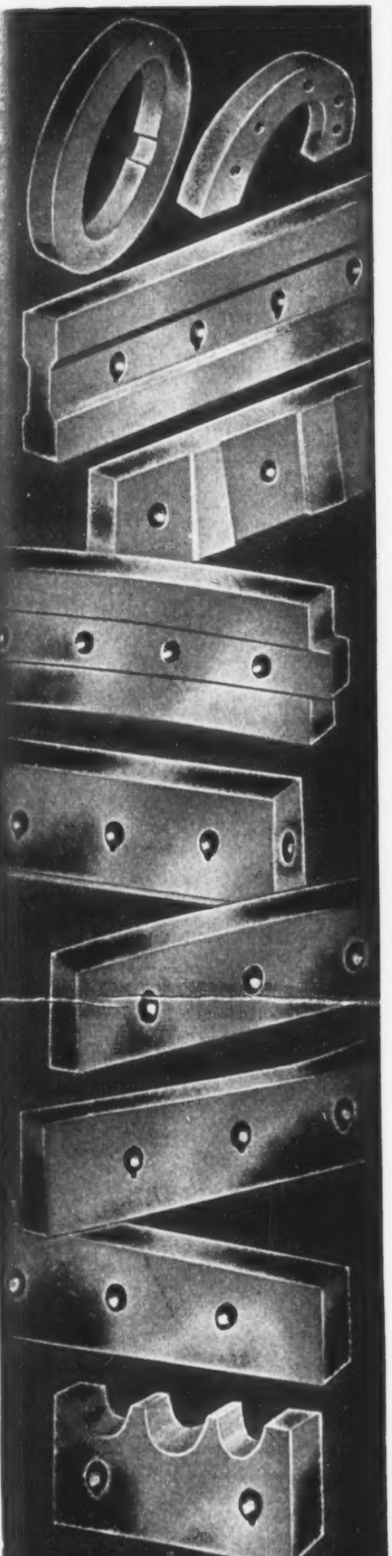
78-82% Mn, maximum contract base price, gross ton, lump size.

F.o.b. Niagara Falls, Alloy, W. Va., Ashtabua, O.	$225
F.o.b. Johnstown, Pa.	$227
F.o.b. Sheridan, Pa.	$225
F.o.b. Etna, Clairton, Pa.	$221

Add $2.80 for each 1% above 82% Mn, subtract $2.80 for each 1% below 78% Mn.

Briquets—Cents per pound of briquet, delivered, 66% contained Mn.

Carload, bulk	1[illegible].45
Ton lots, packed	1[illegible].05



Ferroalloy Prices

Spiegeleisen

Contract prices gross ton; lump, f.o.b

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Palmerton, Pa.	$84.00	$85.00
Pgh. or Chicago	84.00	85.00

Manganese Metal

Contract basis, 2 in. x down, cents per pound of metal, delivered.
96% min. Mn, 0.2% max. C, 1% max. Si, 2.5% max. Fe.

Carload, packed	36.95
Ton lots	38.45

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, cents per pound.

Carloads	30.00
Ton lots	32.00
Less ton lots	34.00 to 37.06

Low-Carbon Ferromanganese

Contract price, cents per pound Mn contained, lump size, del'd Mn 85-90%.

	Carloads	Ton	Less
0.07% max. C, 0.06% P, 90% Mn	28.45	30.30	31.50
0.07% max. C	27.95	29.80	31.00
0.15% max. C	27.45	29.30	30.50
0.30% max. C	26.95	28.80	30.00
0.50% max. C	26.45	28.30	29.50
0.75% max. C, 80-85% Mn, 5.0-7.0% Si	23.45	25.30	26.50

Medium Carbon Ferromanganese

Mn 80% to 85%, C 1.25 to 1.50. Contract price, carloads, lump, bulk, delivered, per lb of contained Mn .... 21.35¢

Silicomanganese

Contract basis, lump size, cents per pound of metal, delivered, 65-68% Mn, 18-20% Si, 1.5% max. C. For 2% max. C, deduct 0.2¢.

Carload bulk	11.40
Ton lots	13.05
Briquet, contract basis carlots, bulk delivered, per lb of briquet	12.65
Ton lots, packed	14.25

Silvery Iron (electric furnace)

Si 14.01 to 14.50 pct, f.o.b. Keokuk, Iowa, or Wenatchee, Wash., $95.00 gross ton, freight allowed to normal trade area. Si 15.01 to 15.50 pct, f.o.b. Niagara Falls, N. Y., $93.00. Add $1.00 per ton for each additional 0.50% Si up to and including 17%. Add $1.00 for each 0.50% Mn over 1%.

Silicon Metal

Contract price, cents per pound contained Si, lump size, delivered, for ton lots packed.

96% Si, 2% Fe	18.00
97% Si, 1% Fe	18.50

Silicon Briquets

Contract price, cents per pound of briquet bulk, delivered, 40% Si, 2 lb Si briquets.

Carloads, bulk	6.95
Ton lots	8.55

Electric Ferrosilicon

Contract price, cents per pound contained Si, lump, bulk, carloads, delivered.

25% Si	20.00	75% Si	14.30
50% Si	12.40	85% Si	15.55
90-95% Si			17.00

Calcium Metal

Eastern zone contract prices, cents per pound of metal, delivered.

	Cast	Turnings	Distilled
Ton lots	$2.05	$2.95	$3.75
Less ton lots	2.40	3.30	4.55

Ferrovanadium

35-55% contract basis, delivered, per pound, contained V.

Openhearth	$3.00-$3.10
Crucible	3.10- 3.20
High speed steel (Primos)	3.20- 3.25

—Ferroalloy Prices—

Alsifer, 20% Al, 40% Si, 40% Fe, contract basis, f.o.b. Suspension Bridge, N. Y.
Carloads 9.90
Ton lots 11.30

Calcium molybdate, 46.3-46.6% f.o.b. Langeloth, Pa., per pound contained Mo $1.15

Ferrocolumbium, 50-60% 2 in. x D, contract basis, delivered per pound contained Cb.
Ton lots $4.90
Less ton lots 4.95

Ferro-Tantalum-Columbium, 20% Ta, 40% Cb, 0.30 C. Contract basis, delivered, ton lots, 2 in. x D, per lb of contained Cb plus Ta $3.75

Ferromolybdenum, 55-75%, f.o.b. Langeloth, Pa., per pound contained Mo $1.32

Ferrophosphorus, electrolytic, 23-26%, car lots, f.o.b. Siglo, Mt. Pleasant, Tenn., $3 unitage, per gross ton $65.00
10 tons to less carload $75.00

Ferrotitanium, 40% regular grade, 0.10% C max., f.o.b. Niagara Falls, N. Y., and Bridgeville, Pa., freight allowed, ton lots, per lb contained Ti $1.35

Ferrotitanium, 25%, low carbon, 0.10% C max., f.o.b. Niagara Falls, N. Y., and Bridgeville, Pa., freight allowed, ton lots, per lb contained Ti $1.50
Less ton lots 1.55

Ferrotitanium, 15 to 18%, high carbon, f.o.b. Niagara Falls, N. Y., freight allowed, carload per net ton $177.00

Ferrotungsten, standard, lump or ¼ x down, packed, per pound contained W5, ton lots, delivered $5.00

Molybdic oxide, briquets or cans, per lb contained Mo, f.o.b. Langeloth, Pa. $1.14
bags, f.o.b. Washington, Pa., Langeloth, Pa. $1.13

Simanal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio, freight allowed, per pound
Carload, bulk lump .... 14.50¢
Ton lots, bulk lump .... 15.75¢
Less ton lots, lump .... 16.25¢

Vanadium Pentoxide, 86 - 89% V_2O_5 contract basis, per pound contained V_2O_5 .... $1.28

Zirconium, 35-40%, contract basis, f.o.b. plant, freight allowed, per pound of alloy.
Ton lots .... 21.00¢

Zirconium, 12-15%, contract basis, lump, delivered, per lb of alloy.
Carload, bulk .... 7.00¢

Boron Agents

Borosil, contract prices per lb of alloy del. f.o.b. Philo, Ohio, freight allowed, B, 3-4%, Si, 40-45%, per lb contained B.... $5.25

Bortam, f.o.b. Niagara Falls
Ton lots, per pound .... 45¢
Less ton lots, per pound.... 50¢

Carbortam, Ti, 15-21%, B, 1-2%, Si, 2-4%, Al, 1-2%, C, 4.5-7.5%, f.o.b. Suspension Bridge, N. Y., freight allowed.
Ton lots, per pound .... 10.00¢

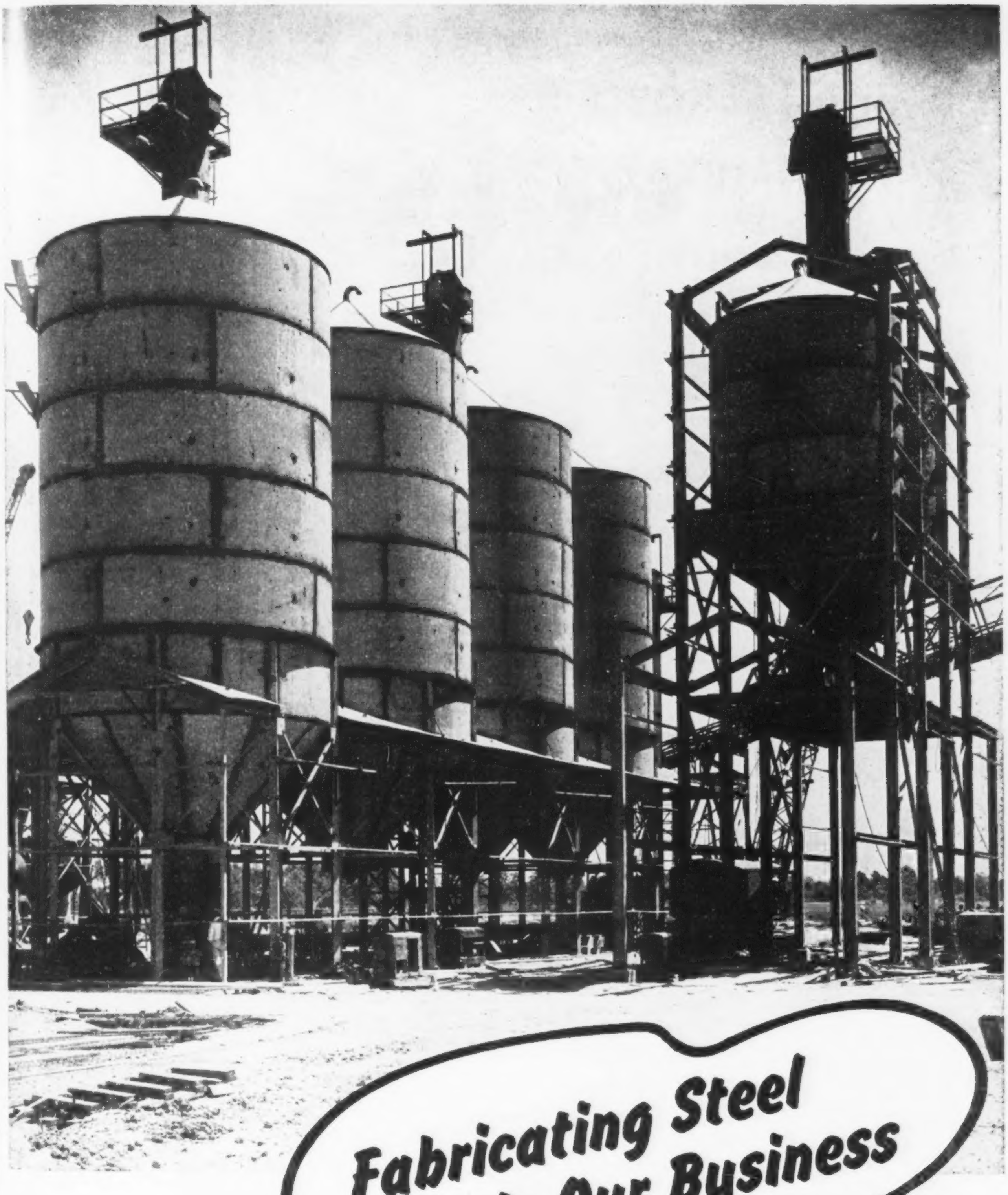
Ferroboron, 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C, 1 in. x D. Ton lots.... $1.20
F.o.b. Wash., Pa.; 100 lb up
10 to 14% B .... .85
14 to 19% B 1.20
19% min. B 1.50

Grainal, f.o.b. Bridgeville, Pa., freight allowed, 100 lb and over.
No. 1 .... $1.00
No. 6 .... 68¢
No. 79 .... 50¢

Manganese - Boron, 75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C, 2 in. x D, del'd
Ton lots $1.46
Less ton lots 1.57

Nickel-Boron, 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni, delivered
Less ton lots $1.80

Silcaz, contract basis, delivered.
Ton lots .... 45.00¢



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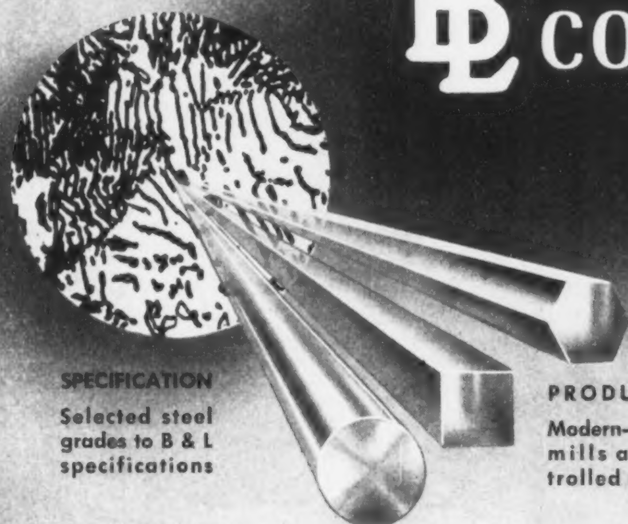

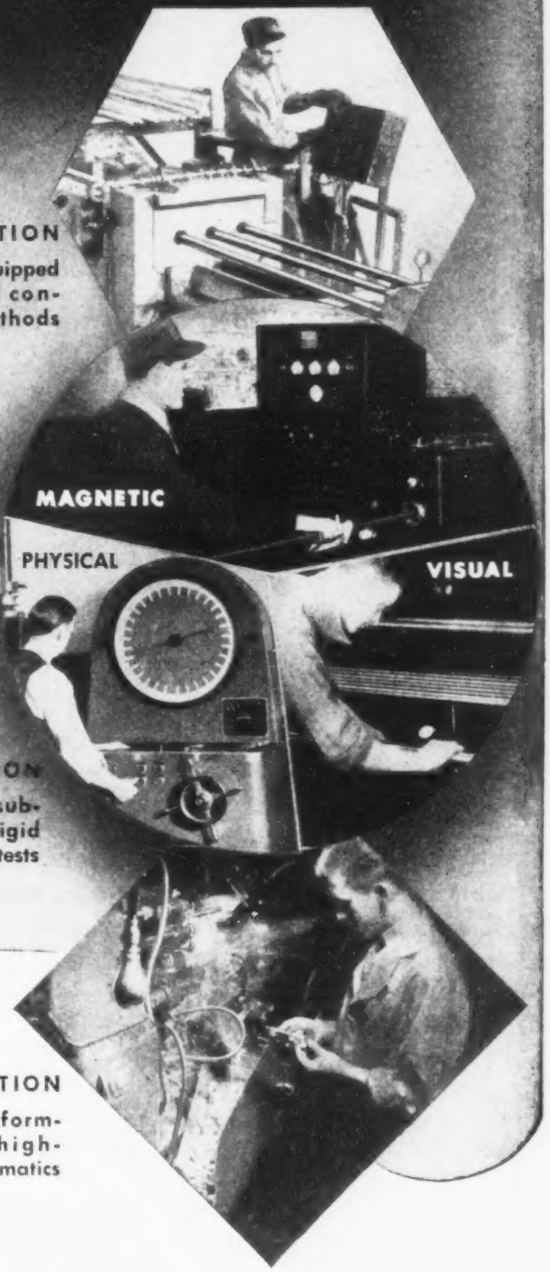

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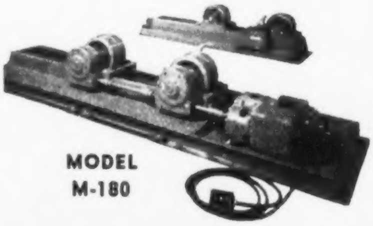

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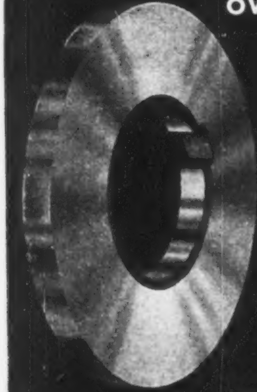

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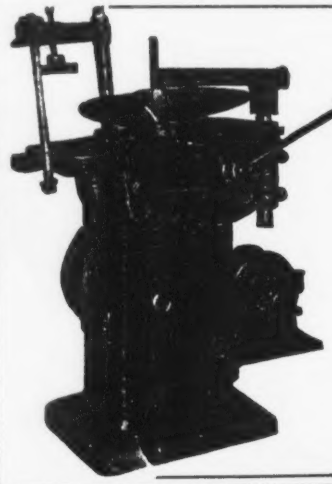

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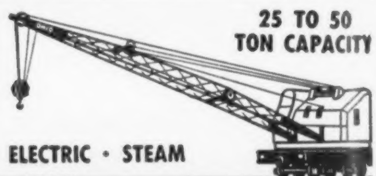

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NEWS OF USED, REBUILT AND SURPLUS MACHINERY

Midwest Market—Action in the Midwest used machine tool trade seems to be holding at last month's level, though several dealers reported a slight drop during the month.

Machine tool rebuilders were in good shape, boasting order backlogs that guaranteed work for at least several months. Deliveries of spare parts are improved, but delays on hard-to-get items are still running up to several months.

Perhaps a reflection of the dealers' dim view of their market in the near future is the recent drop in their warehouse inventories of used machine tools. Dealers are still buying and canvassing desirable equipment, but the most concentrated effort is on the selling end. Their own purchases are falling off, as they attempt to lower their stocks of used equipment.

Strongest demand in the Midwest area is for vertical mills, radial drills and grinders. Vertical mill attachments are also moving well.

New Tool Threat—Speedup of new machine tool shipments is causing considerable concern in the trade. With the market for older tools already on rubber legs, dealers fear the increased availability of new tools may weaken their position even more. It was expected that shipments of foreign tools might be cut even further for the same reason.

Diversity of opinion on foreign tools continues. Many dealers are still worried about the problem of replacement parts, but a new pattern is emerging among those who have tried selling foreign tools.

Faster From Europe—Dealers handling the foreign equipment report they have been receiving replacement parts by air express faster than they can get spare parts for domestic machines from U. S. manufacturers. In one case, delivery time on a foreign spare part was only 10 days.

Firms that have had favorable experience with foreign machine tools indicate they will continue to deal in this equipment. Stocks, however will be limited to a very few lines. Only equipment that is an excellent buy or units that can compete with domestic equivalents on a price basis, even in a much slacker market, will be carried. Small lathes and milling machines will probably be the lead items in these highly selective inventories of foreign tools.

Main problem troubling dealers handling foreign tools is the recent price markup on certain types of equipment. Some dealers are blaming these price boosts on the importers.

Heavy foreign equipment is moving rather slowly in the Midwest. Last week a buyer could purchase English, Belgian, German, Danish and Swedish equipment at dealers' showrooms.

An indication of European tool manufacturers' desire to stop the ebb of U. S. imports of machinery is their attempt to speed up shipments. One Swedish firm claimed it could ship equipment from its home plant to New York in less than 6 weeks.

New Chapter — The vigorous Machinery Dealers National Assn. is hoping to set up another chapter in Milwaukee. A meeting of the MDNA Board of Directors is planned for the middle of this month in Milwaukee and prospects of establishing a new chapter there will be discussed at that time.

Current paid membership of the MDNA is 219. Association goal is 300 members by the time of the next MDNA convention.

Price Book—Latest from association headquarters on the now yellowing price book is that it should be out sometime around the end of this month. Office of Price Stabilization has not given a definite date, but says page proofs are now okayed.

CONSIDER GOOD USED EQUIPMENT FIRST

AIR COMPRESSORS
11" x 12" Pennsylvania Air Compressor, 100# Pressure, Complete with 75 H.P. Syn. Motor
" & 11" x 14" Sullivan WJ-3 Air Compressor 885 CFM, Driven by 150 H.P. Westinghouse Syn. Motor 440/3/60

BAR TURNING MACHINE
Medart HF-2 Bar Turning Machine, Capacity 1" to 2½", Complete with Accessories

BENDING ROLLS
6' x ⅝" Ryerson Pyramid Type Bending Roll
20' x 1" Southwark Pyramid Type, Bending Roll
30' x 1" Southwark Pyramid Type, Motor Driven

BRAKES—LEAF TYPE
8' x ¼" Dreis & Krump Leaf Type Bending Brake Motor Driven with 5 H.P. A.C. Motor
12' x 3/16" Chicago #226 Steel Apron Brake, M.D.
10' x ¾" Dries & Krump Leaf Type Bending Brake, Motor Dr. with 40 H.P. A.C. Motor

BUILDING
72'6" x 140' Steel Building — NEW — Designed for Corrugated Steel Siding—and to carry load of 30 ton Overhead Electric Traveling Crane

BULLDOZER
#9 Williams White Bulldozer, Motor Dr. with 50 H.P. Motor, 440 volt, 3 phase, 60 cycle. Face of Crosshead 20" x 90" Movement of Crosshead 24"

CHARGING MACHINE
6000 lb. Brosius Floor Type Gasoline Driven Charging Machine. Equipped with Peel, Buda Gasoline Engine, Rubber Tires.

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5 ton Whiting Two Leg Gantry Crane 52' Span Cab Control, Motors 220 v. 3 ph. 60 cy.
15 ton P&H Two Leg Gantry Crane 45' Span With 13' Overhang one end, 10' other end 5 ton Auxiliary, Two Trolleys and 5 Motors, 440 volt 3 phase 60 cycle

CRANES—OVERHEAD ELECTRIC TRAVELING
5 ton Robbins Myers 28'6" Span 220/3/60
6½ ton Shepard-Niles 80' Span 440/3/60 AC With 2½ yd. Clamshell Bucket
10 ton Shaw 67' Span 230 Volt D.C.
10 ton P & H 40' Span 440/3/60 AC
10 ton Erie 60' Span 440/3/60 AC
15 ton Niles 60' Span 230 Volt D.C.
15 ton Toledo 46' Span 220/3/60
20 ton Bedford 50' Span 220/3/60 AC
30 ton Morgan 68' Span 230 Volt DC With 5 ton Auxiliary

DIEING MACHINES
75 ton Henry & Wright High Speed Dieing Machine Double Roll Feed. Scrap Cutter. 3" Stroke
100 ton Henry & Wright Dieing Machine, 4" Stroke, 13" Shut Height, Complete Elecl. Equip.

DIE CASTING MACHINES
Model BA-12 KUX Die Casting Machine, Air operated. Plunger Gooseneck Type for zinc, lead & tin. Die space between bars 12¼" x 12¼", Die Separates 8" NEW 1949, never used
Pratt & Whitney Type BL-2416 Single Spindle 3-Dimensional Keller Machine, with complete electrical equipment and accessories

FLANGING MACHINE
⅝" McCabe Pneumatic Flanging Machine, Pneumatic Holddowns, Circle Flanging Attachment

FORGING MACHINES
4" National
1½", 2", 3", 4", 5", Ajax
1", 2", 3", 5", Acme
5 Ajax—Air Clutch

FURNACES—HEATING
60 KW Leeds & Northrup Home Furnace #9478-UB-28. With controls. Work space 28" dia. x 28" deep

FURNACES—MELTING
400 lb. Moore Type "UT" Melting Furnace. Top Charge. Complete with Transformer. New 1943—Little Used.
15 ton Heroult Model V-12 Top Charge Hydraulically Operated, Complete with Transformer Equip.
25 ton Moore Size "NY" Melting Furnace With 7500 KVA Transformer 13,400/3/60

GEAR REDUCERS
500 H.P. United Combination Reduction Gear & Pinion Stand, Gear Ratio 8.581:1
600 H.P. Farrel Birmingham, Size 18 Reduction Gear, Ratio 720 to 244 RPM
700 H.P. Falk Single Reduction Gear, Ratio 875 to 200 RPM
1800 H.P. Mesta Gear Reduction Unit, Ratio 19:1

GRINDER
No. 4 Cincinnati Centerless Grinder, Motor Driven, Capacity standard work rest 2" to 6" dia., optional work test ½" to 3". Special fixtures will allow work to be handled up to 9" dia.

GRINDER—CYLINDRICAL
14 x 36" Norton Type C, Complete with Elecl. Equip.

HAMMERS—BOARD DROP
1200, 1600, 4000 lb. Model J2 Chambersburg
1000 lb. Billings & Spencer

HAMMERS—STEAM DROP
1500, 4000 lb Erie

HAMMERS—STEAM FORGING
1200 lb. Massillon Single Frame
1500, 1600, 2000, 3000, 4000 lb. Chambersburg
600, 1500, 2500 lb. N.B.P.
600, 1100, 1500, 2000, 2500, 3500, 4000# Erie
20,000 lb. Massey Steam Forging Hammer

HAMMERS—MISCELLANEOUS
No. 6N Nazel Hammer, Geared Motor Drive
200 lb. Bradley Compact Hammer, Arr. for Motor Drive with 10 H.P. A.C. Motor

WE OFFER A COMPLETE LIQUIDATION SERVICE ON ANY BASIS WHICH CIRCUMSTANCES INDICATE WOULD BE MOST BENEFICIAL, WHETHER BY AUCTION, PRIVATE LIQUIDATION OR OUTRIGHT SALE

CONSULTANTS IN MANUFACTURING PROBLEMS FOR OVER A QUARTER OF A CENTURY

THERE IS NO SUBSTITUTE FOR EXPERIENCE

CONTACT US IN CONFIDENCE WITHOUT COST OR OBLIGATION

2000 lb. Chambersburg Pneumatic Hammer Complete with Elect. Equip. New 1951
15"x12" Chambersburg Cecostamp Hammer, 18" stroke

LATHE—TURRET
Model 2L Gisholt Geared Head Turret Lathe, Spindle Bore 4-1/16". Elecl. Equipment and numerous accessories incl. NEW 1951

LEVELERS—ROLLER
36" McKay 17 Roll Leveler, 5¼" Dia. Rolls Belted Motor Drive
60" Aetna Standard 17-Roll Leveler, 4⅝". Dia. Rolls Arr. Motor Drive.

MOTORS
1250 H.P. Westinghouse Induction Motor 6600 volt 3 phase 60 cycle 593 R.P.M.
2000 H.P. General Elec. Induction Motor 6600 volt 3 phase 60 cycle 600 R.P.M.
2500 H.P. General Elec. Direct Current Motor 6600 volt 175/350 R.P.M.

MOTOR GENERATOR SET
740 H.P. General Electric Syn. Motor 4400 volt A.C. with two generators 750 KVA 230 volt D.C., Complete with Panel Board, etc.

NAIL MAKING MACHINES
No. 1½ National—Sizes 10D, 12D, 16D, 20D, 30D
No. 3 National—Size 6D
No. 2 Glader—Sizes 6D, 7D, 8D, 9D
Angell—Sizes 10D, 12D, 16D, roofing

PLANER—PLATE EDGE
30' x 1¼" Southwark Plate Edge Planer, Motor Driven. Equipped with 16 Pneumatic Jacks

PRESSES—HYDRAULIC
No. 200 Milwaukee Briquetting Press, Complete with Pumps. Piston Load 118 tons. Hydraulic Operating Pressure 2100 lbs. psi.
75 ton Williams White Straightening Press, 27" Stroke. Bed 8' x 16". 6½" Dia. Ram
200 ton Bliss Hydrodynamic 48" Stroke Bed Area 24" x 24". Hyd. Pump Incl.
500 ton Southwark Hydraulic 24" Stroke, 78" Daylight Platen 64" R to L x 32" F to B
500 ton Southwark Open Throat Hydraulic Press 12" Stroke Platen 56" x 56"
700 ton Elmes Forming Press, 27" Stroke, 30" Dia. Ram, Platen 40" x 88" with overhang 40" x 129" Complete with Pump & Motor

PRESS—HYDRAULIC WHEEL
100 ton Elmes Inclined Hydr. Wheel Press 72" Between Parallel Bars Complete with Pump & Motor

PRESS—KNUCKLE JOINT
#27 Bliss Knuckle Joint Embossing & Coining Press 1000 ton Capacity, 2½" Stroke, 18" Shut Height

PRESSES—STRAIGHT SIDE
No. 87A Bliss 250 Ton Capacity, Double Geared 32" Stroke, 30" x 33" Bed Area Air Cushion
No. 305 Bliss 9" Stroke 14" Shut Height Equipped with Marquette Air Cushion
No. 59 Toledo Double Geared Tie Rod Press 255 ton Friction Clutch 18" Stroke 36¼" x 35" Bed Area
No. 3 Ferracute Super Speed Punch Press 30 ton Capacity. NEW 1946—never used
No. 675B Bliss Single Geared 1½" Stroke, Double Roll Feed & Chopper, 10 H.P. A.C. Motor.
No. 620 Bliss High Production Press, 1½" Stroke
SI-40 Verson 200 ton Press, 30" Stroke Bed Area 40"x44"
No. 12 Zeh & Hahnemann Patent Percussion Press 150 ton 12" Stroke 17" x 17" Bed Area
No. 10-E Bliss 800 Ton, 10" Stroke Bed Area 60" x 126"
No. 7 Bliss 400 Ton 8" Stroke Bed Area 48" x 108"
No. 1037-5/8 Hamilton 300 Ton 16" Stroke Bed Area 48" x 104"
No. 93½C Toledo 175 Ton, 6" Stroke Bed Area 40" x 72"
No. 606½ Hamilton 165 Ton, 12" Stroke Bed Area 36" x 60"
No. 93½D Toledo 150 Ton, 8" Stroke Bed Area 36" x 51"

PRESSES—TRIMMING
Bliss S.8 Trimming Press with Side Shear, 250 Ton Capacity, 8" Stroke 52"x30" Bed Area
No. 3 Erie Flywheel Drive Trimming Press, 3¾" Stroke 13" Between Guides
No. 18 Erie Trimming Press, 100-150 Ton

PUNCH—BEAM
Long & Allstatter Double End Beam Punch, Capacity Beam Punch End—Punch flanges and web 24" I-beam and smaller

PUNCH & SHEAR COMBINATIONS
Ryerson Steel Frame Universal Ironworker, M.D. Capacity Punch ⅝" thru ⅝" Shear 1" Square, 1¼" Round, ½" x 4" Flats 4 x 4⅛" Angles
No. 28 U-30 Buffalo Armor Plate Universal Ironworker. Capacity Punch 1½" thru 1¼", Shear 3" Round 3⅝" Square, 5 x 1⅝" Flat, 5 x 5⅝" Angles.
Style EF Cleveland Single End Punch & Shear, M.D. Capacity Punch 1" thru 1⅛"

RIVETER
125 ton Hanna Bull Riveter, Air Driven, 24" Gap, 75" Reach. Capacity 1" rivets cold and 1½" rivets hot

ROLL—PLATE STRAIGHTENING
7 Roll Bertsch Plate Straightening Machine, Capacity 10' x ¾", Complete Elecl. Equip.

ROLLING MILLS
7½" Steckel Four High Rolling Mill, Max. Steel Width 6". Work Rolls 2½" x 7½", Complete with electrical equipment
8"x10" Schmitz Single Stand Two High
12"x16" Single Stand Two High, Comp. with Elecl Equip.
12"x24" Waterbury Farrel Two High
18"x24" Waterbury Farrel Two Stand Two High
20"x36" Poole Two Stand Two High
22"x40" Single Stand Two High
27"x56" United Two High Skin-pass Mill
28"x60" Single Stand Two High
18"x60" Three High Roughing Mill, Complete with billet heating furnace and accessory equipment incl. elecl. equip.

ROLL—TAPER FORGING
No. 00 Williams White Taper Forging Roll. Rolls 24" Dia., Shaft 8" Dia.

SAW
No. 3 Ryerson Friction Saw, 54" Blade Hydraulic Feed, Complete with Elecl. Equip.
52" Ryerson Friction Saw, 45 H.P. Motor Capacity Approx. 9" Round, 20" I-beam, 12" H-beam

SHEAR—ALLIGATOR
No. 7 Thomas Carlin Alligator Shear, 16" Blade, 30 H.P. D.C. Motor

SHEARS—ANGLE
Hilles & Jones No. 2 Double Angle Shear, M.D. Capacity 6" x 6" x ¾"
Long & Allstatter Double Angle Shear, Model B, Capacity 6x6x¾". Complete with Elecl. Equip.

SHEAR—BAR
No. 2 LH Lewis Open End Bar Shear, Motor Drive, Capacity 1½" Round

SHEAR—GATE
10'x1" Cincinnati Model 10010 Gate Shear, New 1946 —Little Used

SHEARS—ROTARY
No. 60 Quickwork Rotary Shear, ¾" Capacity
No. 100 Kling Rotary Shear, 1" Capacity
No. 30 Quickwork Rotary Shear, 5/16" Capacity
Quickwork Heavy Duty Circle Shear ⅝" Capacity Complete with Circle Cutting Attachment

SHEARS—SQUARING
12'x3/16" Stamco Steel Squaring Shear, Motor Dr
8' x ¼" Drabert Model THZ 6/2500
8'x 3/16" Cincinnati Series 1408, Motor Driven
6' x ¼" Long & Allstatter, Belted Motor Drive

SLITTERS
31" Yoder Sheet Slitter No. 530, Capacity 3 cuts .194" to 8 Cuts .156", Motor Dr.
72" Yoder Gang Slitter, Capacity 5 Cuts 20 Ga.

STRAIGHTENERS
No. 3 Medart 3-Roll Straightening Machine Capacity 1" to 3½" bars or 4½" O.D. Pipe or Tubing. NEW 1950.
No. 4 Kane & Roach 8-Roll Straightener Capacities 3" Rounds or Squares, 3x3x⅝" Angles 2½" Channels, etc.
No. 1½B Sutton Round Straightener, Motor Dr. Capacity Tubing 5/16" to 2⅞"—modified to handle up to 3½" O.D. tubing
No. 1B Sutton Round Straightener, Motor Drive Capacity 3/16" to ⅝" O.D. Friction Drive complete with 1/3 H.P. A.C. Motor
Hallden 8-Roll Strip Straightener, Flying Shear & Cutting Machine, Capacity 14" wide 11 Ga. Sheet Steel

STRETCHER
McKay Hydraulic Bar Stretcher, Capacity up to 1⅝" dia. in lengths 12' to 27'

SWAGING MACHINES
No. E4 Langelier, Capacity 1½" Tubing
No. 408 Etna Swager, Capacity 4" Tubing

TESTING MACHINES
300,000# Southwark Emery Universal Hydraulic
60,000 lb. Olsen 4 Screw Rotating Nut Type Universal
20,000 lb. Southwark Emery Universal Hydraulic

TRIMMING LINE
#1049 Torrington Trimming Line, With Feed Rolls and Scrap Cutter, Capacity for steel or aluminum alloys ⅛" max. Trimmed width 22" min. 66" max., Scrap Length ⅜" min., 3¼" max.

TUBE MILL
Complete equipment for hot rolling seamless steel tubes ranging in sizes from 6⅝" to 14⅝"

WELDERS
250 KVA Progressive Model A-6 Flash Welder 440 volt 60 cycle. Mechanical Contactor Hi-Pressure Clamp Assembly—NEW 1949
McKay Tube or Pipe Welding Unit, Capacity 4⅝" to 7½" O.D. Complete with all accessory equipment and motors

WIRE DRAWING MACHINE
No. 0 Waterbury Farrel 7-Die Wire Drawing Machine, Capacity ¼" rod to #10 copper

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AND MACHINE TOOLS

AU OMATIC SCREW MACHINES
GY MATIC Model 40 15/8" 6 spindle. Late
CL ELAND 3¾ Model A; Late Type.

BO NG MILLS—Horizontal
LA DIS #40, 4" Bar; floor type; M.D.
LA DIS #35 floor type; 3½" bar; M.D.
LU AS 41", table 24"x48"; M.D. Late
NI S 8" bar floor type, motor drive
UN ERSAL 3" bar, table 40"x58", M.D. Late

BO ING MILLS—Vertical
BE S 120" 2 heads Rapid Traverse; M.D.
BU LARD 54", N.E. Type; motor drive.
BU LARD 42" spiral drive; M.D.; late type.
BU LARD 8", 16" 6-spindle "A" Mult-au-matic
CO BURN 72", 2 heads PRT. M.D.
NI ES 53", 2 swivel heads, motor drive.
NI ES 100", 2 swivel heads; motor drive
NI ES 120", 2 swivel heads; Rapid Traverse; M.D.

BRAKES & SHEARS
BESCO 16 gauge 60" Press Brake; NEW.
BESCO 12 gauge 72" Press Brake; NEW
BESCO 36", 20 gauge Power Sq. Shear; NEW.
BESCO 48", ⅛" gauge Power Sq. Shear; NEW.
BESCO 72", 14 gauge Power Sq. Shear; NEW.
BESCO 96"x⅛" Power Sq. Shear; NEW.
BESCO 96"x¼" Power Sq. Shear; NEW.
CHAMBERSBURG 500 HP, Billet Breaker; late
JAMES RENNIE No. 8 Univ. Ironworker; late
NIAGARA No. 116 Squaring Shears; late type.
QUICKWORK No. 5 ⅜" rotary, M.D.
QUICKWORK No. 6, 1" capacity; motor drive.
WORMSER T-15; T-25; Univ. Ironworker; new

BROACHES
AMERICAN T-6-32 Vertical; hydr. 3-way; late.
CINCINNATI 1-30 Duplex Vert. Hydr.
COLONIAL, VGI 4-10-48; Vert. Hydr., late.
OILGEAR 3XA Horizontal Int.; Late.

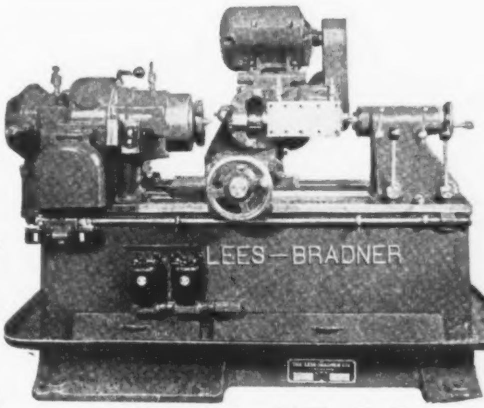
DRILLS—Radial
CINCINNATI BICKFORD 6'15" Univ.; M.D.
KITCHEN & WADE 3' arm 12" col. M.D.

DRILLS—Miscellaneous
AVEY No. 3, Ball bearing, Motor drive.
BAKER No. 217; Motor drive.
BARNES No. 420 Deep Hole; late.
BARNES H-3 Hydram; hydr.; inverted; late.
BARNES H-2 Hydram; hydr.; M.D.
BARNES 20" 4-spindle Camel Back; Late.
CINCINNATI 21", Motor drive.
FOOTE-BURT, 6-spindle, late type.
LeBLOND No. 2, deep hole, late type.
LEMAIRE, 5-spindle, late type.
MOLINE, 6-spindle Hole-Hog 3¾"; M.D.
NATCO No. 14 Mult.; Rect. Hd.; PRT; M.D.

GEAR CUTTING EQUIPMENT
BILGRAM 6" & 16" Bevel Gear Cutter, M.D.
BROWN & SHARPE 6-72" Auto. Cutter; M.D.
CROSS #1, #40, #45 Tooth Rounders; M.D.
DETROIT type GG-35 Gear Grinder; late type.
FELLOWS Nos. 61A, 6Z2, 75, 71, 7A, 72, 77 High Speed Gear Shapers; late.
FELLOWS 13-LS Lapper; late.
GLEASON #20 Tester; Late Type.
GLEASON 25" straight dbl. gear gen.; M.D.
GLEASON #13 bevel cutter-grdr. M.D.; late.
GLEASON 18" bev. gear Tester; M.D.
GLEASON #6 Revacycle; Late Type.
GLEASON No. 12 Tool Sharpener; late.
GLEASON 12" Straight Bevel Gen.; late.
GLEASON #4 & #6 Tester, Late Type.
GLEASON 10", 11" & 18" Bevel Gear gen.
GLEASON 24", 37", 77", 96" Bev. Gear Planer.
GLEASON No. 14 Hypoid Grinder; late.
MICHIGAN Finisher, Mod. 862-24-A, 24"; late.
MICHIGAN #854 Gear Shaver; Late.
PRATT & WHITNEY 10" Gear Grinder; late.

GEAR HOBBERS
BARBER COLMAN 12# Motor Drive.
BARBER COLMAN Type A; Late.
GOULD & EBERHARDT #12H; Late.
GOULD & EBERHARDT #18H, Motor Drive.
GOULD & EBERHARDT #36BM 3 spindle Auto. Rougher; M. D.
KOEFFER WM-11 Auto.; bench type; Late.
PFAUTER RS1; Max. dia. 30"; late.

GRINDERS—Plain Cyl. & Univ.
BROWN & SHARPE #5 3x18" Pl. Cyl.; late.
CINCINNATI 14x72 Model EM Plain, Late.
LANDIS 16x36" Type C Plain, Hydr. Late type.



LEES-BRADNER Thread Milling Machine

LANDIS 10x36" Type C Plain, Hydr. Late type.
LANDIS 10x18" Type C; late type.
LANDIS 30"x240" Plain cyl., M.D.
NORTON 10x72; type C; plain; M.D.
NORTON 10x120; plain; M.D.
NORTON 14x50"; plain; Motor drive.

GRINDERS—Surface
ARTER 8" Rotary, M.D.
BILLITTER & KLUNZ 48"x196" Way Grinder.
BLANCHARD #16 Hi Power Vertical; Late.
HEALD #22 Rotary, 12" chuck; M.D.; Late.
PRATT & WHITNEY 14x36" Model B, Late.
THOMPSON 2V Special; late type.

GRINDERS—Miscellaneous
BRYANT No. 3 Internal; hydraulic; late.
BRYANT No. 5 Internal; hydraulic; late.
BRYANT No. 16-C-16 Internal; hydraulic; late.
BRYANT No. 16-CP-16 Internal; hyd.; late.
BRYANT No. 24 Internal; hydraulic; late.
EXCELLO #48 Carbide; Late.
HEALD 75A, special internal; late type.
HEALD No. 72-A-5 "Gagematic" Int.; Late.
HEALD No. 72-A-3 "Gagematic" Int.; Late.
HEALD 72-A-3, 72-A-5 Plain; Late.
HEALD No. 78 Internal Centerless; M.D.
LEMPCO 22x72" Mod. KG Crankshaft; Late.
VAN NORMAN 666 Crankshaft Regrind.
VAN NORMAN 639 Osc. type Radius; Late.

HEADS AND UPSETTERS
ACME 2" Model XN, late type.
AJAX 3½" Upsetter, motor drive.
MANVILLE #3 DSOD, Motor Drive.
MANVILLE #2 DSOD, Motor Drive.
MANVILLE #1A DSSD, Motor Drive.
WATERBURY FARREL #11, DSSD, M.D.

LATHES—Engine & Mfg.
AMERICAN 36x33" centers geared heavy.
DENHAM 16x48" centers, Gap; late type.
DENHAM 12x54" centers, Gap; late type.
DENHAM 16x72" centers, Gap; late type.
GRAHAM NORMANTON 12"x48" centers; late.
HENDEY 12"x54" centers, belted motor drive.
JONES & LAMSON "FAY" 20x25" Auto. Late.
LEHMANN 16"x30" Hydratrol; late type.
LEHMANN 25x96" center; Timken; grd. M.D.
LeBLOND 16x36" center; Auto.; Timken; late.
LeBLOND Mod. 7ACL Crankshaft; M.D.
LODGE & SHIPLEY 14"x30" Centers, late type.
LODGE & SHIPLEY 16"x30" Centers, late type.
LODGE & SHIPLEY 24"x96" Centers, Late.
LODGE & SHIPLEY No. 5—24" and 96" centers DUOMATIC Timken; Late.
LoSWING 4x60", 8x24", 8x108"; late.
MONARCH 14"x42" type Z. Magnamatic; late.
NILES 30"x46', 30"x50' Boring; "Time-Saver"; Timken; Late.
PORTER-McLEOD 16"x6', 16"x8'; NEW.
PRATT & WHITNEY 16"x30", Timken; late.
REED-PRENTICE 14"x54", Timken; late type.
SPRINGFIELD 16"x30" Centers, Timken; late.
SPRINGFIELD 14'x43", geared; M.D.
SUNDSTRAND 10x60" Auto.; Late Type.
SWIFT 16"x72" Centers; M.D.; Late.
SWIFT 20"x120" Centers; Late.

LATHES—Turret
MOREY No. 2 ram type TIMKEN.
BARDONS & OLIVER #3 universal; late type.
GISHOLT 1L, Saddle type, M.D.
MAGDENBERG Model MWF-BG-250 Univ. table type; P.R.T.; 12" hole through spindle; cross sliding turret; M.D.; Late.
WARNER & SWASEY 4-A, Timken Bearing, 7½" Bore, motor drive.

MILLING MACHINES—Pl. & Univ.
KEMPSMITH #2 Timken; Univ. M.D.
CINCINNATI 4-48, 4 spindle, Tracer; Late.
ROCKFORD Rigid-Mill #3; M.D.
STARR No. 2, table 13"x55"; late.
RICHMOND #2, light, late type.

MILLING MACHINES—Mfg.
CINCINNATI O-8 vertical; late.
GOULD & EBERHARDT 25 Cont. type; M.D.
INGERSOLL 32x24x16' Planer Type; 2 hds.
INGERSOLL 30x24x12' Adj. Rail Slab; M.D.
SUNDSTRAND Mod. 3A Duplex 42" feed; M.D.
TAYLOR & FENN M-80 Duplex Spline; Late.

MILLING MACHINES—Thread
HALL Style D Planetary, Late Type.
LEES-BRADNER HT 12"x54", M.D.; Late.
LEES-BRADNER HT 12"x36", M.D.; Late.
MOREY 12x30" centers, 12x120" centers, late.
PRATT & WHITNEY 4½x12 Mod. C; late.

PLANERS
BETTS CONSOLIDATED 108" x 84" x 44', 4 heads; PRT; Box Table; M.D.
GRAY 24x24x6'; motor drive.
GRAY 36"x36"x10', 4 heads, PRT; Late.
LIBERTY 144"x76"x48" adj. variable, openside, box table; 4 heads, PRT; M.D.
NILES 108"x84"x42', 4 heads; Rapid Traverse; Box Table DC; M.D.
NILES-BEMENT-POND 72"x72"x30', 4 heads; Rapid Traverse; M.D.
NILES-BEMENT-POND 60"x60"x12'. Rapid Traverse, 2 swivel heads, box table; M.D.

SAWS
CAMPBELL #401 Abrasive cut-off; Late.
ESPEN LUCAS No. 670 30' cap, Hydr.; Late.
GROB OS-20 metal band saw & filer; Late.
HELLER Model SS-1, 6¾ Cap Cold Saw.

SHAPERS—Slotters
DILL 18" Slotter; motor drive.
PRATT & WHITNEY 6" Vertical; M.D.
PRATT & WHITNEY 10" Vert., M.D.
LYND FARQUHAR 26" Openside; M.D.
NEWTON 15" Slotter; M.D.
ROCKFORD 36" Vertical, Hydr.; Late Type.

PRESSES
NEW Presses from 5 ton to 400 ton O.B.I., back flywheel, straight side.
Available from stock

BIRDSBORO 325 ton Vert. Hydr.; Late.
BLISS #6 SS DC 135 ton; 34"x95" bed; 2½" stroke; 60 SPM.
BLISS No. 410A Toggle Draw'g; tie rod; geared
BLISS No. 3½A geared toggle; dble. acting.
GLEASON 15" Quenching; hydr.; M.D.
HANNIFIN 6-ton, 16-ton; hydr.; Late.
NATIONAL #5 H.S. Maxi-Press (Forging).
SENTINEL 25-ton OBI; NEW.
SHORE, 250 ton Hydr. Flanging & Forging.
WATERBURY FARREL 125 Ton; St. Side.

MISCELLANEOUS
BAKER #5 Keyseater; motor drive.
BARNES No. 172, 214 Honing; hydr.; Late.
BAUSH #1 Radial tapper; late type.
FISCHER No. 1, Oil Groover; Late.
GROB OS-20 Metal Band Saw—Filer; M.D.
HUGH SMITH 1"x24'6" Plate bend. rolls; M.D.
LANDIS 2" Dble. Spdle. Threaders; M.D.
LeBLOND #2 Barrel Rifling Machine.
LeBLOND #2 Barrel Lapper; M.D.; Late.
MANVILLE #2C Screw Slotter; Motor Drive.
MANVILLE #1 Screw Slotter; Motor Drive.
MANVILLE No. 3 Trimmers; Late.
MANVILLE No. 3C Thread Roller; M.D.
SAUNDERS 8-18" Pipe Machine; M.D.
US TOOL 310-B Cutter Reliever; Late.
WATERBURY FARREL No. 11 Thread Roller.
WEYBRIDGE Slitter; 36x22 gauge; NEW.

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BORING MILLS
Bullard 24" V.T.L., Spiral Drive
Cleveland 2½" Bar Cap.
Giddings & Lewis No. 32, 3" cap.
King 42", 72" Vert. 2 rail heads
Niles-Bement-Pond 4", 4½" Bar, 60" Vert.
Niles-Bement-Pond 63" Vert.
New 3" Hor. Bor. Mills

DRILLS AND RADIALS
American 6'x15" Univ.
Baush Multi-spindle
Buffalo #2 Motor Spindle
Canedy-Otto 21" Sliding head New
Cincinnati Bickford 6'x15" col.
Natco #12 20 spindle drill, Baush
24" Sibley Sliding head
New Geared Box Col. Drills 24"
Foote-Burt #25 3" cap.
Leland Gifford 2 LMS 3 MS

ENGRAVERS
Deckel type 3 Dim., New
Gorton 3S Die Sinker
Gorton 3Z, 3U
Gorton #1A, ME, Deckel GIL
Taylor-Hobson 3 dim.

GEAR EQUIPMENT
Barber-Colman #2, #12 (3), Flather 72" Cutter
Fellows High Speed Shapers 712, 725, 71
Fellows #20M Redliner
Flather 72" Cutter
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
Michigan Gear Finisher 24" cap., 862-24-A
National Broach Red Ring Lapper
Schuchardt & Shutte #1 Hobber

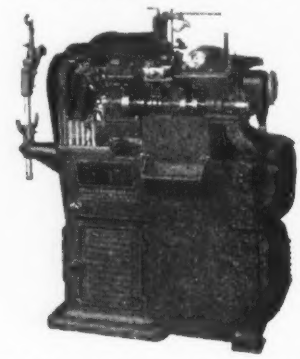
GRINDERS, MISCELLANEOUS
Bryant #5, Internal, chucking, 16A16
Cincinnati 6x18" Cyl. Hyd.
Grenby Models 1G1 & 1G2
Heald #73 Internal Centerless, Sizematic
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic
Landis 6"x30" Type C Cyl., 10x24 Univ.
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 6"x30", 10"x18" Type C cyl.
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
Sellers 6T Tool, K.O. Lee tool
Van Norman #666 Crankshaft

GRINDERS, SURFACE
New 8x24" Hyd. Feed, 10x18"
Abrasive 8x24", #33 Vert. & #34
Blanchard #16, 26" Mag. Chuck
Heald 22—12" chuck, Arter 12"
Norton 6x18" Hyd. 10x36" Hydr.
Portman 12" Chuck Rotary
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base, 2A 6x18
Taft Pierce #1 Precision

LATHES
American 14"x30
Bridgeford 36"x20', 32"x16'
Hendey 12"x42" and 12x30", 1941, 16x66"
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed, 19x42"
Lipe-Carbo 12"x18" (2)
Pratt & Whitney 16"x60—Late
Lodge & Shipley #3A, #3 Duomatics
New 16, 18, 20", 28" Immediate Del.
Reid Small Piece #9WSL
Rivett Model 918 Precision
Sundstrand 8x15", 15' Stub
Sebastian 12"x4' G.H., Sheldon 12"
Wickes 32"x35' Geared Head

TURRET LATHES
Acme 6W Fox 2-9/16" Cap. #2 Cross Slid. Turret
Bardons & Oliver #2, 3, 5, 7
Brown & Sharpe, #2 Hand, #10, 11
Denver 6 2" Shell Turret (2)
Foster #2B 2½" Cap. Morey #2G Late
Gisholt 2L, Cross Slid. Tur. #5 Bar Feed, Chuck
Gisholt Simplimatic
Jones & Lamson #5, Bar Feed
Morey #2G Late
Oster 601 WD, #2 Simmons Microspeed
Warner & Swasey #1A, Timken Head
Warner & Swasey #1, 2, 3, #4 Preselector

SCREW MACHINES AUTOMATICS



Brown & Sharpe (12) Model 0G, serial Nos. 9600 & 10700 series, ⅝" capacity.
Brown & Sharpe (7) Model 00G, serial Nos. 14 15, 16000 series, ⅜" capacity.
Brown & Sharpe (4) Model 2G, serial Nos. 8500 & 11500 series, 1¼" capacity.
Cleveland, Model AA-11, Serial #36586.
Cleveland, Model B, Serial #42618 843, 1-1/16" capacity.
Conomatic 4 Spindle, Serial 2309FF, 1½" capacity.
New Britain Gridley 61 6 Spindle, Serial No. 25410, 1⅝" capacity.

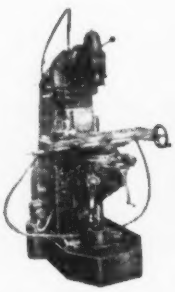
NEW IN STOCK
Air Hydraulic Presses — Arbor Presses #6C Famco—Band Saws Kalamazoo—Famco 6x12"—Drill Presses all sizes—Hydraulic Press Northern 20 Ton — Injection Molders, 1 ounce — Power Presses, OBI, 1, 4, 4½, 5, 7½, 10, 15, 20, 30, 55, 85 ton—Shaper 7" Amco, 8" Shaperite—Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power 3'x18 gauge to 10' x 10 ga.—Welders, Arc, Seam, Spot all sizes Motors, Grinders, Buffers.

PRESSES
Bliss 645, 650 Hi-Production Presses
Bliss 18, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton SS, Bliss 74½
Hamilton 850 Ton S. S. Bed 27x48
Hamilton 110 FM Die Tryout Press
Bliss 5-48 Dbl. 32x48" bed, Cushion
Toledo 92½c Dbl. Crank 43x23" bed.
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Niagara Horning, 15 Ton
Niagara A1¾ O.B.I.
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton, LJ #3

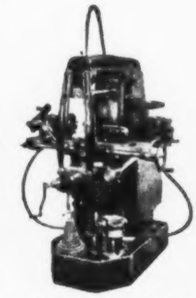
MILLS, PLAIN, UNIV. PROD.
Brand New Universal Mills No. 1, No. 2
Archdale Plain, 14", Production
Brown & Sharpe #3B Plain, Late, 3A, 21, #2L
Cinn. No. 3, 4 Plain Spd., 18" Manufacturing
Kent Owens 1V, 1-8, 1-14, 1M
Kempsmith #1 Pl., Vert. & Div. Hd
Milwaukee 2K, 2H Univ., 2H Plain
Milwaukee #2B, Plain & Univ.
Sundstrand #00, 0, Rigidmils
Sundstrand #3A Rigidmil with copying Attach. 33
Van Norman #2L Univ.

MILLS, VERTICAL
Brand New Vertical Mills
Cincinnati #3, #4 hi-power, #4 Dial Type
Cincinnati 03 Vertical
Morey #12M Profiler, 2 sp.
Pratt & Whitney Profiler 12B, 2 sp.

MILLS, VERTICAL, NEW

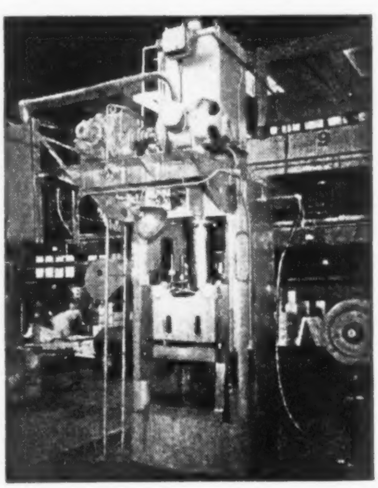


New Vertical Mill Universal Table, Swivel Head



New Universal Mill with Dividing Heads and Vertical Attachs.

MISCELLANEOUS
Band Saw: DoAll Zephyr 36", 1"0 Metalmaster
Bolt & Pipe Threader: Landis, Oster-Williams #915 Pipe & Nipple Threader
Broach: 3L LaPointe Hydro. Horiz. New Klink. 6 Ton
Hacksaw: Peerless 6"x6"
Honer: Micromatic H-4
Keyseater: Davis, Baker
Oil Groover: WICACO
Shapers: 24" Rockford, 24", 28" Gould & Eberhardt, Cinn. 20", 24"
Shears Power: George Ohl 10' 3/16", 10' x 16 gauge, 11' x 16 gauge
Welder: 50 KVA Eisler Air Operated, New Seam
Welder: Taylor-Winfield 50 KVA Hi-Wave



150 Ton H.P.M. Triple Action Press 50 ton cushion, 50 ton blankholder, bed 36" x 36".

HYDRAULIC EQUIPMENT
SELF CONTAINED PRESSES
150 Ton Triple Action HPM Press
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
8 and 9 oz. Injection Moulders

MISCELLANEOUS PRESSES
300 Ton Watson Stillman 20"x20" Platen 8" St. 19" opening

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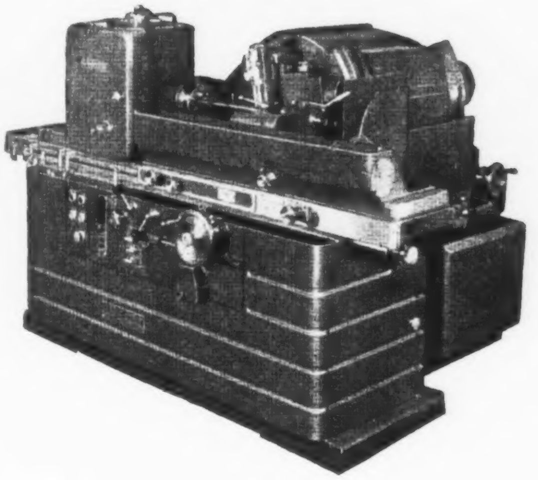


NO. 35 EXCELLO PRECISION THREAD GRINDER

Max. diameter of work ground (with 18" wheel) 8"

Max. diameter of work ground (with 14" wheel) 12"

Max. diameter work inserted through work spindle 1⅝"

Max. threaded portion of work (from Headstock center) 22"

Grinding wheel speeds, 1485, 1575, 1670, 1780, 1910, 2040, 2150, 2290, 2450, 2640 R.P.M.

Work spindle speeds—grinding 2 to 160 R.P.M.

Approx. weight: 9200 lbs.

*Monthly rental approximately $375.00 per month.

25" x 72" LANDIS HYDRAULIC PLAIN CYL. GRINDER
30" diameter x 3" face grinding wheel
With 3 A.C. 220/440 volt motors & electrical equipment
*Monthly rental approximately $500.00 per month.

GEAR MACHINES

No. 7125A Fellows Gear Shapers, 1943

No. 72 Fellows Gear Shaper, 1945

No. 61-A Fellows Gear Shaper, 1942

8H Gould & Eberhardt Gear Hobber

No. 140 Cleveland Rigid Hobber, 1947

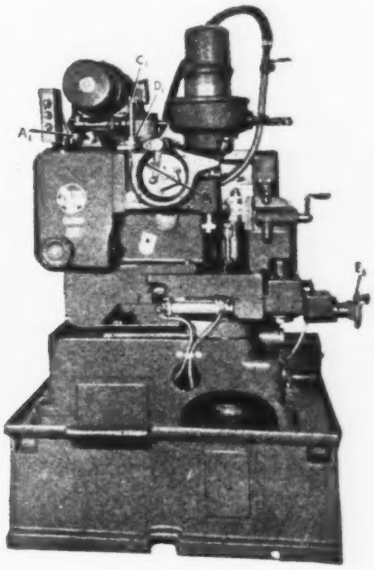
NO. 7125A FELLOWS HIGH SPEED GEAR SHAPER
Max. pitch dia. ext. spur 7"
Max. pitch dia. ext. helical 7"
Max. pitch dia. int. spur or helical 6"
Max. pitch spur 5/7
Max. face width 2"
Max. helix angle 45 deg.
Equipped with 1½ H.P. 3 phase, 60 cycle, 220/440 volt, 1135 R.P.M.
With 2" raising block
Weight approx. 3100 lbs.
*Monthly rental approximately $165.00 per month.

LATHES

4—No. 1FU FOSTER FASTERMATICS, Complete equipped, Air Chuck, Air Cylinder, Turret Tools, Hydraulic Cross Facing Attachments, New 1941

*Monthly rental approximately $425.00 per month.

*All monthly rentals apply in full against purchase price.



NO. 1402 MILWAUKEE SIMPLEX MILL

Timken bearing spindle

Spindle speeds, 12; 20-200 R.P.M.

Table working surface 72" x 13"

Table travel 24"

Power rapid traverse

Feeds ½" to 20" per min.

Spindle adjustable in and out, up and down

Weight approx. 9,000 lbs.

*Monthly rental approximately $200.00 per month.

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Colborne Mfg. Bench Type Speed Lathe, m.d.
No. 4 LeBlond Boring Lathe, 37' bed, 13" hole
No. 9, 12 LeBlond Multi-Cut, m.d.
3½x36", 3½x80", 4x60", 8x84" LoSwing, m.d.
8x132" LoSwing, m.d., latest
9x12" Sundstrand, s.p.d.
11x18" Leblond Rapid Production, m.d.
12x18" centers Monarch Model 5T, m.d.
17"x6' LeBlond Automobile Mfg., cone
17"x8' LeBlond Automobile Mfg., cone
20"x8' LeBlond Mfg., m.d.
21"x8' LeBlond Turret Lathe, cone
Schauer Type NA28 Speed Lathe, m.d.

ENGINE LATHES
12"x6' Lodge & Shipley Geared Head, m.d., taper
13"x30" centers Pratt & Whitney Model B, m.d., taper
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Lodge & Shipley Geared Head, m.d.
14"x6' Pratt & Whitney, cone
14"x6' LeBlond, cone
14"x6' Sidney Geared Head, m.d.
14"x6' Springfield Geared Head, m.d., taper
14"x8' Prentice, m.d., taper
14"x8' Sidney Geared Head, m.d.
15"x8' LeBlond, m.d., taper
16"x36" Pratt & Whitney Geared Head, m.d.
16"x54" centers American, m.d.
16"x6' Cisco Geared Head, m.d.
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' Lodge & Shipley, cone
16"x6' bed Monarch Geared Head, m.d.
16"x84" Pratt & Whitney Type B, m.d.
16"x8' Reed-Prentice Heavy Duty, cone, taper
16"x8' Monarch, cone, motorized
17"x6' LeBlond Geared Head, m.d.
18"x5' LeBlond Geared Head, m.d.
18"x6' bed Lodge & Shipley, cone, motorized
18"x6'6" Greaves-Klusman Geared Head, m.d. in leg
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Selec. Head, m.d.
18"x8' Champion, cone
18"x8' Whitcomb-Blaisdell Geared Head
18"x8'6" bed Walcott, cone, motorized
18"x10' Boye & Emmes, m.d.
18"x10' Springfield Geared Head, m.d., taper
19"x6' centers LeBlond Geared Head, m.d., taper, late
20"x10'6" bed Schumacher & Boye, cone, motorized
20"x8' bed American Geared Head, m.d., taper
20"x8' Cisco, cone
20"x8' bed Greaves-Klusman Geared Head, m.d. in leg
20"x9' bed Boye & Emmes
20"x10' Boye & Emmes, cone
20"x10' Lodge & Shipley Geared Head, m.d.
20"x10' Sidney Geared Head, m.d.
21"x8' Heavy Duty LeBlond Geared Head, m.d.
21"x10' LeBlond Geared Head, m.d.
23"x12' LeBlond Geared Head, m.d., taper
23"x12' LeBlond, cone, motorized
23"x14' bed LeBlond Geared Head, m.d., taper
24"x10' Lodge & Shipley Geared Head, m.d., taper
24"x10' American, cone
24"x10' Greaves-Klusman Geared Head, m.d.
24"x12' bed Boye & Emmes, belt drive
24"x12' Bridgeford Geared Head, m.d., taper
24"x13' bed Lehmann Geared Head, m.d., taper
24"x16' bed American, cone, motorized
24"x16' bed Cisco, cone, motorized
24"x24' bed Lodge & Shipley Geared Head, m.d., taper
24"x30' bed American Geared Head, m.d., taper, late
25"—50"x8' centers LeBlond Gap Lathe, m.d.
26"x8' Bridgeford Geared Head, m.d.
30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" bed Niles-Bement-Pond, m.d.
30"x16' bed Lodge & Shipley Geared Head, m.d., taper
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48" American (raised to swing 54") x 17' bed, m.d.
42" Putnam (raised to swing 56½") x 20' bed Geared Head, m.d., 11'8" centers
30" raised to swing 44" x 15' bed American, m.d.

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3/16" x 60" x 120"
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6" x 6" x 20# x 40'
8" x 8" x 31# x 40'
8" x 8" x 40# x 40'
10" x 10" x 49# x 40'
10" x 10" x 60# x 40'
12" x 12" x 65# x 40'

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45 tons—1¼" x 1¼" x 3/16" x 20'
20 tons—1½" x 1½" x 3/16" x 20'
60 tons— 2" x 2" x 3/16" x 20'
50 tons— 3" x 3" x ⅜" x 40'
50 tons—3½" x 3½" x 5/16" x 40'
50 tons— 4" x 4" x ⅜" x 40'

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Swing with side head in position	41"	57"
Swing with side head below table	51"	57"
Vertical travel of ram	31"	23½"
Horizontal travel, side head	19½"	27½"
Speeds (12)	11.8 to 150 RPM	5.1 to 80 RPM
Motor Drive	25 HP	30 HP

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1. The names and addresses of the publisher, editor, managing editor and business managers are:

Publisher, George T. Hook, 100 E. 42nd St., New York 17, N. Y.

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Managing Editor, G. F. Sullivan, 100 E. 42nd St., New York 17, N. Y.

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GEORGE T. HOOK, Publisher

Sworn to and subscribed before me this 22nd day of September, 1952.

MAE A. GATZENMEIER

My commission expires March 30, 1954.

[Seal]

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100" BETTS Vertical Boring Mill

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No. E5 NATCO Multiple Spindle Drill—Hyd. table, '42

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No. 12 FELLOWS Gear Shaver, 1943
No. 36BM GOULD & EBERHARDT Gear Rougher

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14" x 54" REED PRENTICE Geared Head Engine Lathe
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30" x 16' bed AMERICAN "High Duty" GH
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FURNACE—Roller Hearth, I.D. 15'8" x 3'6" x 11"
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PRESS—Plate Bending, 2000 Ton for forming cyl. shells, 14' W x 2½" Thick
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PRESSES—Hyd. 100-2800 Tons for 105 mm shells
RIVET HAMMER—6B Hi-Speed
STRAIGHTENING PRESS—2000 Tons (Plate)
NUT-TAPPERS—¾", 6 Spindles (2)
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Chambersburg 1200 lb., 1600 lb., 2000 lb. and 2400 lb. Type "F"
United Engineering 3000 lb.—New ram

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Bertsch 18' x 1⅜" cap. Pyramid Bending Roll—100 HP main drive and 50 HP elevating motor—1944 machine—Excellent condition

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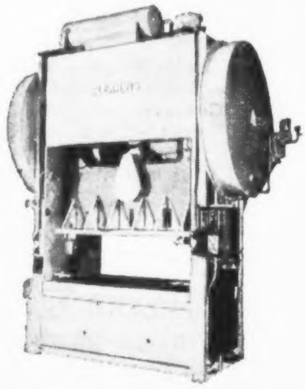

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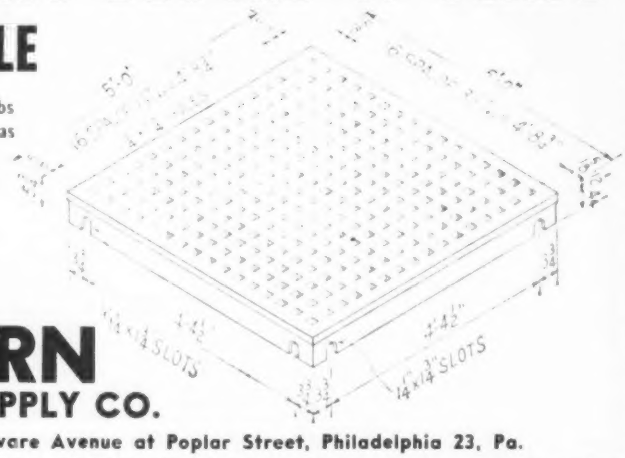

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SQUIRREL CAGE MOTORS

3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
1	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873C	2200	1160
1	200	Al. Ch.	AR	440/220	580
2	125	Al. Ch.	AR	2200	1750
1	125	Whse.	CS-761-C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-663C	440/220	1750
1	100	Al. Ch.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Whse.	CS-938	2200	495

SYNCHRONOUS MOTORS

3-Phase, 60-Cycle

Qu	HP	Make.	P.F.	Volts	RPM
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	1000	El. Mchy.	100	440	1200
1	750	G.E.	80	2300	450
1	250	G.E.	80	2300	514
1	250	El. Mchy.	80	440	400
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	G.E.	80	550	450
3	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	220/440	900
3	100	G.E.	80	220/440	600

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al. Ch.	720	525	4800
1	2400(3-U)	Whse.	720	600	4800/2400
1	1000	G.E.	514	550	2300
2	500	C.W.	720	575	2300/440
1*	500	C.W.	720	250/275	2300/440
1	500(3-U)	Whse.	1200	250	440
1	300	Al. Ch.	1200	250	2300
1	250	Whse.	1200	125/250	2300
1	200	Whse.	1200	125/250	2300/440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Al. Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	C.W.	1200	125	440/230
1	100	Ridgway	1200	275	4000/2300

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complete with control
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Qu	HP	Make	Type	RPM
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(Spare armature with anti-friction bearings for above)				
1	150/200	Whse	MCB-100	370/300
1	100/140	Whse.	MCB-90	500/415
4*	100/140	G.E.	MDA-108	430/500

Qu	HP	Make	Type	RPM
2	100/140	G.E.	MDA-108	430/500
1	100	G.E.	CO-1831	360
2*	100	G.E.	CO-1831	675
1*	75/100	Whse.	CK-10	500/675
1	75/60	Whse.	K-10	425/470
5	70/90	Whse.	MCA-70	440/400
2	70/90	Whse.	MCB-70	440/400
1	54/80	C.W.	FW	575/480
4	57/45	Whse.	K-9	470/515
2	65/85	G.E.	CO-1830-A	700/650
1	50/65	G.E.	C-1830-A	525/450
4	50	G.E.	CO-1810	725
2	50/65	Whse.	MCA-60	475/425
1	50	G.E.	CC-1829	750
3*	35	G.E.	CC-1828	875
1	35	G.E.	CO-1809	725
1	30/40	Whse.	MC-50	525/440
1	30	C.W.	EH	750
2*	16/19	C.W.	BW	620/560
6	10/15	Whse.	K-5	630/560
2	15/19	G.E.	CO-1807	650/575
1*	17	G.E.	MDA-103	700
2	15	G.E.	CO-1806	875
1	16/13	G.E.	MDS-406	615/700
1	13/17	G.E.	MDB-103	645/725
1	11/13	C.W.	A2W	1050/910
2	10/13½	Whse.	MCA-41	725/610
1*	12	G.E.	MDA-102	975
3	10/13½	G.E.	MDA-404	800/700
1	10	Whse.	CK-4	525
2	8/9½	C.W.	AW	695/635
2	7½/6½	Whse.	K-3	195/680
1	7½/10	G.E.	MDA-403	800/650
1	7½/10	C.W.	SWS-7½	900/675
1	10/7	G.E.	MDB-102	800/1025
5	12/9	G.E.	MDA-102	875/725
1	10/7	G.E.	MDA-102	1025/800
1*	5/6½	C.W.	SWS-5	1050/925
2*	5/6½	G.E.	MDA-402	1025/925
1	5¼	Whse.	K-2	825
7	3/3¾	G.E.	CO-1803	875/700
9	3	G.E.	CO-1822	875

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13/16" Diameter Weight 978 lbs.
15/16" Diameter Weight 23 lbs.
7/8" Diameter Weight 25 lbs.
1" Diameter Weight 12,000 lbs.
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1 5/16" Diameter Weight 4,403 lbs.
1 3/8" Diameter Weight 2,984 lbs.
1 3/4" Diameter Weight 2,157 lbs.
1 15/16" Diameter Weight 2,400 lbs.
3" Diameter Weight 219 lbs.

TYPE 304

1/2" Diameter Weight 500 lbs.
1 5/16" Diameter Weight 1,000 lbs.
3" Diameter Weight 200 lbs.
3 1/4" Diameter Weight 620 lbs.

TYPE 309

5/16" Diameter Weight 600 lbs.

TYPE 321

1" Diameter Weight 10,000 lbs.

TYPE 347

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500	West.-Rotary	1200	250	2300
500 (2)	G.E.-Rotary	1200	250	13,200
400	West.-MG	720	550	2300
400	West.-Rotary	1200	125	2300
400	West.-Rotary	1200	250	2300
300	G.E.-MG	1200	250	2300
300	G.E.-Rotary	600	250	2300
300 (2)	West.-MG	1200	250	2300
300	G.E.-Rotary	1200	250	2300
200	G.E.-MG	1200	250	2300
200	G.E.-MG	1200	125	2300
150	G.E.-MG	1200	250	2300
150	G.E.-MG	900	250	2300
100	Ridg.-MG	1200	250	2300
35	G.E.-MG	1750	125	220/440

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	G.E.	450	Sl. Rg.
300	G.E.	450	Sl. Rg.
150	G.E.	450	Syn.
100	West.	900	Syn.
100	West	1200	Sq. Cg.
100 (2)	G.E.	1750	Sq. Cg.
100 (2)	G.E.	450	Sl. Rg.
75	West.	900	Sq. Cg.
60	West.	600	Sl. Rg.
50	G.E.	1750	Sq. Cg.
40	G.E.	900	Sl. Rg.
40	West.	900	Sq. Cg.
30	G.E.	1200	Sq. Cg.

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SINCE 1915
HEADQUARTERS FOR USED ROLLING MILLS AND STEEL WORKS EQUIPMENT

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1—24" BILLET MILL, 2-high, continuous, including 6 horizontal stands, 1 vertical edging stand and gear drive. Accessories include tables, cooling bed, and motor driven shear. *Available at very low price for prompt removal.*
1—56" 2-HIGH TEMPERING MILL FOR STRIP, including uncoiler, recoiler, motors and controls.
1—18" BAR MILL, single stand, with tilting table, drive and furnace.
1—ROD MILL for non-ferrous metals, including motors and coilers.
3—9" x 12" UNITED COLD MILLS, 2-high, individual drives, combination pinion stands and gear reduction sets, coilers.
1—2500 H.P. DC MOTOR, 175/350 RPM
1—2000 H.P. MOTOR, 6600 volts, 3 phase, 60 cycle, 600 RPM.
1—1250 H.P. MOTOR, 6600 volts, 3 phase, 60 cycle, 600 RPM.
1—1500 H.P. GEAR REDUCTION SET with flywheels, ratio 570 to 35 RPM.
1—ROLLER LEVELLER, 17 rolls, 60" face, with motor drive.
1—BAR STRETCHER, hydraulic, capacity up to 1¾" dia. x 12 to 17' long.
1—BAR SHEAR, capacity 3½" round.

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Up To Double These Gauges
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Equipped with Hele-Shaw Pumping self contained system.—3,000 PSI

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65-ton Whitcomb Diesel Electric Loco. Class 0-4-4-0, 580 HP. New 1944.

44-ton Gen. Elec. Diesel Electric Loco. New 1945. Class 0-4-4-0. 380 HP

14 Western 30 cu. yd. Side Dump Air Dump Cars. All Steel Drop Door and Lift Door Type.

MISSISSIPPI VALLEY EQUIPMENT CO.
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ROLLER HEARTH:
Surf. Comb. 84" x 29' Radiant Tube
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Elec. Furn. Co. 24"x13' Elec.–170KW
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Warehouse Stocks of
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American, steam, 50 ton revolver. 60' gantry, one year minimum.

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40 ton Browning Diesel 30 ton Industrial Diesel
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16 ton Whitcomb S/G $2,500.00
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ONE OF THE LARGEST STOCKS IN THE EAST
Seamless and Welded ⅛" to 26" O.D.
All wall thickness Manufactured.
Specialty large sizes.
Cutting — Threading — Flanging —
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800 H.P. MILL MOTOR
800 HP, 870 RPM Westinghouse Slip Ring. Type CW, 2200/3/60.
Complete with semi-automatic control panel & flexible coupling.

F. H. CRAWFORD & COMPANY, INC.
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23 NEW STEEL TANKS
9—10,000 GAL. CAP. ¼ IN. SHELL
5—15,000 GAL. CAP. 5/16 IN. SHELL
9—20,000 GAL. CAP. ⅜ & 5/16 IN. SHELL
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MACHINES FOR YOUR YARD
Silent Hoist Krane Krawler
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Lessman front end loader
Butler fork lift truck
Butler Carscoop
20"x40' port. belt conveyor
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FOR SALE
1948 Invoice Price

Unused 90 inch Cupola, Skip Hoist Charger, Blower with Automatic controls all in original container. Purchased as a unit.

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LIFTING MAGNETS
A complete magnet service. Magnets, new & rebuilt, generators, controllers, reels, etc.

Magnet specialists since 1910

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1½", 2" National and larger sizes.

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Ball Headers, all sizes, ¼", ⅜", ½", ⅝" Double Stroke Solid Die.

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USED COLUMN FACING MACHINE
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BRIDGE CRANES
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CHICAGO 6, ILLINOIS
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3—2000 to 3000 FT. CAP.
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WANTED

2,000 to 3,000 KVA ELECTRIC FURNACE TRANSFORMER WITH TAP CHANGER, for 20,000 volts primary, 50 cycle, 3 phase current in good condition also circuit breaker for same.

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PUMPS, ELECTRIC MOTORS, ETC.
CONTRACT 413

SEALED BIDS will be received by the Board of Water Supply, at its offices, thirteenth floor, 120 Wall Street, New York City, until 11:00 A.M., Eastern Standard Time, on Tuesday, October 28, 1952, for Contract 413, for furnishing, testing and delivering deep well turbine pumps and deep well plunger pumps, electric motors and appurtenances for the Neversink intake chamber, the Downsville release water chamber and the intake and outlet chambers of the East Delaware tunnel, of the Delaware system, all as set forth in the specifications.

No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn and made payable to the order of the Comptroller of the City of New York, in the amount of four thousand dollars ($4,000.00), for the proper execution of the contract.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders, forms of bid and contract, specifications, contract drawing, requirements as to surety, etc., can be obtained in Room 1311, at the above address, upon application in person or by mail, by depositing the sum of five dollars ($5.00) in cash or its equivalent for each pamphlet. Within 30 days following the award of contract or rejection of bids, the full amount of such deposit will be refunded for each pamphlet submitted as a bid and a refund of four dollars ($4.00) will be made for each other pamphlet returned in acceptable condition. For further particulars, apply at the office of the Chief Engineer at the above address.

IRVING V. A. HUIE, President, RUFUS E. McGAHEN, EDWARD C. MAGUIRE, Commissioners, Board of Water Supply; RICHARD H. BURKE, Secretary.

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PLATE FABRICATING SHOP. Equipped for heavy plate work and stainless steel. Produces high pressure vessels for chemical industries, refineries, etc. Buildings 200,000 sq. ft. Located Pennsylvania.

MACHINE SHOP & FOUNDRY. Producing castings up to 20 tons. Large backlog of orders. Well established profitable business. Located in the East.

STEEL FABRICATOR. Well established business produces specialties for heavy industry. Business very profitable. Located near New York.

IRON FOUNDRY. Mechanized shop with latest equipment; mould conveyors, sand conveyors, etc. Capacity 125 tons of light castings per eight hour day. In full operation. Suitable for company requiring large amount of small castings. Located in the East.

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Industrial Properties Throughout the East
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Phone Mitchell 2-2450

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Our many buyers for machine shops, foundries, sheet metal shops, pipe and tubular product shops, stamping shops, will invest from $25,000.00 to $2,000,000.00 in going businesses. All interested parties please submit pertinent data including current financial statements.

BENDER REALTY CO.
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If your product is **STEEL**, contact us about the advantages in having us represent you in the New York area with all the advantages of your own New York office at no extra cost.

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The meeting place for employers and men qualified for positions in the metalworking industry.

Help Wanted Rates
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Representatives Wanted Rates
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Set Solid—50 words or less..............$10.00
Each additional word.............. 25c
All capitals—50 words or less............$16.00
Each additional word.............. 32c
All capitals, leaded—50 words or less....$19.50
Each additional word.............. 39c

Situation Wanted Rates
Payable in Advance

Set solid—25 words or less................$2.50
Each additional word.............. 10c
All capitals—25 words or less.............$3.75
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COUNT SEVEN WORDS FOR KEYED ADDRESS

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We now have positions available in practically all fields, including technical service and sales. Salaries range from $4,000 to $10,000. Openings in all sections of the country. Write or phone for full particulars. Your inquiry held in confidence.

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HIGH GRADE MEN — Salaries $5,000 to $25,000. Since 1915 thousands of Manufacturing Executives, Engineers, Sales Managers, Comptrollers, Accountants and other men of equal calibre have used successfully our confidential service in presenting their qualifications to employers. We handle all negotiations. Submit record with inquiry. The National Business Bourse, 20 W. Jackson Blvd., Chicago 4.

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HELP WANTED

W A N T E D

General superintendent or one who is thoroughly experienced in all phases in manufacturing cold finished bars and now acting in supervisory position either as foreman or assistant to superintendent.

Must be able to take full charge of mill operations and understand mill production.

Excellent opportunity offered to right party. Plant located in Eastern Seaboard Area.

Only those with full knowledge and experience need apply.

Replies held absolutely confidential.

ADDRESS BOX S-799
Care *The Iron Age*, 100 E. 42nd St., New York 17

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Wanted: Roll Turner. Experienced on bar mill and special shapes. Please

ADDRESS BOX S-839
Care *The Iron Age*, 100 E. 42nd St., New York 17

HELP WANTED

UNUSUAL SALES OPPORTUNITY

A nationally known company, of outstanding reputation, which makes and supplies basic raw materials to the steel, iron, and nonferrous metal industries, now has a place in its organization for one or more applicants who fully meet its requirements for metallurgical sales representatives.

The men selected will join a rapidly expanding company that leads the field in a basic and important industry. Opportunities for advancement in salary and responsibilities are excellent, and will depend entirely upon achievement.

To qualify, applicants must be 25 to 35 years of age; must be graduates of an accredited metallurgical engineering school; should have three or four years of practical experience in open-hearth or electric-furnace melting; and must be willing to travel.

Consideration will be given to those who furnish full details as to age, education, training, experience, and salary expected. All replies will be treated with strict confidence. Address inquiries to:

Box S-830
The IRON AGE
100 East 42nd Street
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SALES EXECUTIVE

Well connected Steel and Alloy Industries in U. S. Experience in marketing imported metallic ores preferable. Excellent opportunity with well established organization. Please state qualifications in detail.

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HELP WANTED

SALESMAN

Experienced in sale of Steel Pipe and Tubing or related items, to follow-up leads by telephone. Attractive starting salary with opportunity to build a real future for man who qualifies. Location in Midwest. Write in detail, giving complete information in first letter.

ADDRESS BOX S-825
Care *The Iron Age*, 100 E. 42nd St., New York 17

WANTED—Design and Estimating Engineer with Industrial Furnace experience. Write fully giving experience and salary desired. Drever Company, 736-38 E. Venango Street, Philadelphia 34, Pa.

EMPLOYMENT EXCHANGE

HELP WANTED

WANTED

Assembly Yard Superintendent

Fully experienced on shop and yard assembly of structural steel fabrication for all types of bridges.

Excellent opportunity for man of experience — attractive salary and bonus.

ADDRESS BOX S-850
Care *The Iron Age*, 100 E. 42nd St., New York 17

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Investment-Steel Castings

Opportunity for experienced man qualified to direct all phases of business.

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Care *The Iron Age*, 100 E. 42nd St., New York 17

MAN WANTED

Interested in purchase, sale and distribution of Ferro-Alloys. Must have knowledge of sources and consumers. Very profitable position. Write details in first letter.

ADDRESS BOX P-207
Care *The Iron Age*, 814 Park Bldg., Pittsburgh 22, Pa.

DESIGN ENGINEER

10 to 15 years practical experience in designing. Open-Hearth Furnaces. Write giving details to Employment Office.

BETHLEHEM STEEL CO.
501 E. Third St. BETHLEHEM, PA.

HELP WANTED

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Steel Warehouse handling Hot-Rolled Steel seeking salesman. Salary basis. Good prospects. Must have following, especially industrial accounts, Greater New York or New Jersey.

CONCORD STEEL CORPORATION
120 Wall Street New York 5, N. Y.

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Between the age of 45 and 60. Must be familiar with steel mill requirements.

ADDRESS BOX P-206
814 Park Building Pittsburgh 22, Pa.

METALLOGRAPHER

Senior Metallographer needed to take charge of new metallographic facilities in Technical Development Laboratory.

Write ATOMIC ENERGY DIVISION
E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

REPRESENTATIVES WANTED

SALES AGENT WANTED

OLD ESTABLISHED GRAY IRON JOBBING FOUNDRY WANTS REPRESENTATION IN ST. LOUIS. SEND COMPLETE INFORMATION WITH EXPERIENCE AND REFERENCES.

ADDRESS BOX S-848
Care *The Iron Age*, 100 E. 42nd St., New York 17

Specialty Houses concentrating machine tools and appliances wanted by importer to distribute new lines quality tools and accessories from us. Stocks in following areas: Eastern New York, New Jersey, Eastern Pennsylvania and Midwest.

ADDRESS BOX S-852
Care *The Iron Age*, 100 E. 42nd St., New York 17

ACCOUNTS WANTED

MANUFACTURERS AGENT

Accounts wanted by reliable sales firm with Pittsburgh office and covering Western Pennsylvania, Upper New York State, Eastern Ohio, and West Virginia. Call: Atlantic 1-2779.

ADDRESS BOX P-205
Care *Iron Age*, 814 Park Bldg., Pittsburgh 22, Pa.

DETROIT-AUTOMOTIVE MANUFACTURERS' AGENT

Having wide and close acquaintance with buyers and engineers of all of the automobile manufacturers and who has highly successful record, is desirous of representing manufacturer, making any production item or accessory which would be of interest to the car makers.

ADDRESS BOX E-51
Care *Iron Age*, 103 Pallister Ave., Detroit, Mich.

IMPORTING AGENT BRAZIL successful Rio De Janeiro office now visiting New York desires representation serious manufacturers and/or exporters mainly tin plate, steel products, chemicals. Preferably sightdraft basis in view Brazilian letter of credit restrictions. Possible outside financing with buyers furnishing best bank guarantees. Address Box S-856, care *The Iron Age*, 100 E. 42nd St., New York 17.

ESTABLISHED MANUFACTURER'S Agent calling on Manufacturers, Contractors, Architects, Municipalities in Toledo and Northwestern Ohio desires additional accounts. Efficient representation on commission basis. Address Box S-845, care *The Iron Age*, 100 E. 42nd St., New York 17.

WESTERN AND CENTRAL New York State. Well established manufacturers' agent is seeking additional major production line. Excellent sales record. Complete and efficient coverage of industrial plants guaranteed. Address Box S-846, care *The Iron Age*, 100 E. 42nd St., New York 17.

SITUATIONS WANTED

ENGINEERING EXECUTIVE, Vice President, General Manager, Works Manager. Capable administrator with ability to handle comprehensive manufacturing and management problems desires permanent association with medium size firm financially sound. Twenty-five year's manufacturing and management experience including labor relations. Thorough knowledge of modern manufacturing techniques coupled with outstanding Washington contacts. Sound reason for change. Address Box S-855, care *The Iron Age*, 100 E. 42nd St., New York 17.

BAR MILL SUPERINTENDENT—Practical experience 25 years in steel mills. Hand and continuous—Roll Design—Merchant Products—Strip—Alloy Steels—Rolling and Engineering Background. Capable of directing complete operations. Address Box S-783, care *The Iron Age*, 100 E. 42nd St., New York 17.

ROLLING MILL ENGINEER. Twenty-eight years experience as designer and assistant chief engineer with manufacturer of rolling mill equipment. Design, development, proposals and specifications. Available immediately. Address Box S-844, care *The Iron Age*, 100 E. 42nd St., New York 17.

METALLURGIST—4 years experience investigating forging, heat treating, fabricating problems on stainless, high temperature alloys, valve steels desires responsible position with steel mill or fabricator. Address Box S-847, care *The Iron Age*, 100 E. 42nd St., New York 17.

SALES EXECUTIVE dealing with industrial trade has proven record of successfully building two business's from its inception on percentage basis. Only interested in a sound proposition. Address Box S-837, care *The Iron Age*, 100 E. 42nd St., New York 17.

ACCOUNTANT, thoroughly conversant with machine tool and metal working industries desires contact with firms requiring complete or supplementary accounting and tax service. Address Box S-840, care *The Iron Age*, 100 E. 42nd St., New York 17.

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ATTORNEY with general law practice desires responsible position with progressive industrial organization. Address Box S-851, care *The Iron Age*, 100 E. 42nd St., New York 17.

CONTRACT MANUFACTURING

THE DIRECTORY OF PRODUCTION SERVICES

[This section appears in the first and third issues of each month. See advertisers index in these issues.]

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ADVERTISERS IN THIS ISSU

ADVERTISERS IN THIS ISSUE

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ADVERTISERS IN THIS ISSUE

(Continued from Page 457)

ADVERTISERS IN THIS ISSUE

42 SOLD IN 86 DAYS

Pangborn's BLASTMASTER ROTOBLAST Barrels on the production line. A total of 42 sold in 86 days makes it imperative to place your order now for delivery as soon as possible!

Pangborn's BLASTMASTER Rotoblast® Barrel must be good!

Within just 86 days of the introduction of Pangborn's BLASTMASTER ROTOBLAST Barrel, a total of 42 were sold! And experienced foundrymen don't plunk down hard cash unless they *know* what they're getting!

Check the features of this Barrel that add to the performance of ROTOBLAST: Non-clogging work conveyor! Automatic throw-out torque arm! Absolute abrasive-tight door and housing! Efficient cleaning and reclaiming system! Quick-acting work loader! Centrally-located push-button control panel! And all this in a Barrel occupying a minimum of floor space and head room!

See now why the 42 sales? And that's just the beginning! If *you're* interested in more efficient, more rapid, more economical batch cleaning, better get your order in! For more information, write for Bulletin 223 to: PANGBORN CORP., 1500 Pangborn Blvd., Hagerstown, Md.

OVER 28,000 PANGBORN MACHINES SERVING INDUSTRY

Pangborn

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

BLAST CLEANS CHEAPER

with the right equipment for every job

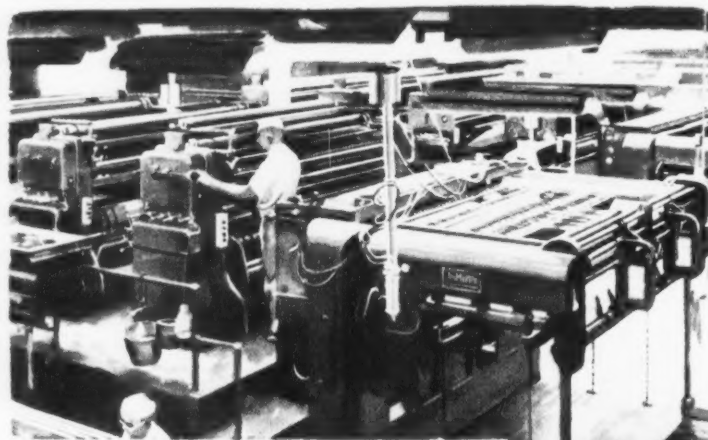
ROTOBLAST saves you money five ways:

SAVES LABOR with push-button operation
SAVES TIME by cleaning more loads per day
SAVES SPACE because machines are compact
SAVES TOOLS because all scale is removed
SAVES POWER since no compressor is needed

Cutler-Hammer to be sure

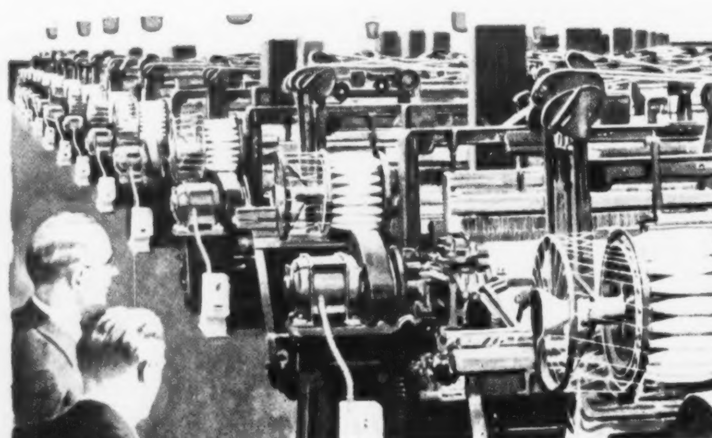
No broader experience . . .

Over the entire range of industrial control needs, from toughest mill jobs to smallest motor drives, every unit of Cutler-Hammer Control offers features born of 60 years experience in *all* industries.



No better engineering . . .

In industry after industry, Cutler-Hammer Control is the specified choice of able technical men quick to respect advanced engineering. As a consequence, many leading machinery builders feature C-H Control.



No finer reputation . . .

Electrical maintenance men *know* motor control, not by claims, but by direct comparison of many makes. Such comparison of motor control performance built the Cutler-Hammer reputation for dependability.

Within recent years, there has been a most evident and logical trend toward the regular specification of brand name in the purchase of motor control. And, more and more, the name thus specified has been Cutler-Hammer. This is also most logical, as no other name in motor control means so much.

For sixty years, Cutler-Hammer engineers have worked with the technical men of *all* industries on their specialized needs in motor control. In industry after industry, they have been in the forefront of progress, devising new control techniques and new control equipment to do things better, faster, and at lower cost. Forever creating to but *one* standard, they have made the Cutler-Hammer name synonymous with dependability wherever motor control is used.

To be *sure*, you too should always specify Cutler-Hammer when buying motor control. This will give you more for your money . . . better performance and longer life at *no* extra cost. Insist on the genuine. CUTLER-HAMMER, Inc., 1325 St. Paul Avenue, Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

Cutler-Hammer general purpose motor control is recommended by a majority of all electric motor manufacturers, is featured as standard equipment by machinery builders, is carried in stock by recognized electrical distributors everywhere.

CUTLER-HAMMER

MOTOR CONTROL

C-H